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Review of USACE Institutional Information Related to Evaluation of Incremental Changes in Water Resources Planning

Larry Canter, Manroop Chawla, and Carl Thomas Swor

March 2011



Proctor Lake, TX, constructed by the Corps of Engineers to provide flood control, drinking water, and recreation

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Abstract: “Incremental changes” implies small to large changes in watershed development activities over time; such activities can influence hydrologic, geomorphic, ecological, and other conditions. This report presents a review of U.S. Army Corps of Engineers (USACE) practices for integrating such changes into planning, as well as National Research Council studies directed to USACE planning, and a chronology report on the Lake Pontchartrain & Vicinity Hurricane Protection Project (LP&VHPP). USACE engineer regulations, guidance manuals, and other documents pertaining to the three primary USACE mission areas (inland navigation, flood damage reduction, and ecosystem restoration) were also reviewed to identify which would require updating to reflect evaluations of incremental changes that could impact project or program performance. Recommendations are made to update or modify specific regulations and guidance.

Cover Graphic Source: Headquarters, U.S. Army Corps of Engineers (HQUSACE), Office of History. 20 November 2007. The U.S. Army Corps of Engineers, “A Brief History,” <http://www.usace.army.mil/History/Documents/Brief/14-water/water.html>

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Preface

This study was conducted for the Headquarters, U.S. Army Corps of Engineers (HQUSACE) under the USACE Campaign Plan. The Campaign Plan has incorporated lessons learned from the events of Hurricanes Katrina and Rita in August 2005, which began with the announcement of the “12 Actions for Change,” a set of concepts to guide USACE in transforming its priorities, processes, and planning. These actions formed the basis for “Actions for Change,” a major transformation initiative involving (1) a comprehensive systems approach to mission execution; (2) implementation and integration of risk-informed decision-making; (3) better risk communication to the public and increased public involvement in risk reduction strategies; and (4) improved professional and technical competence.

The Comprehensive Systems Approach primarily supports USACE Campaign Plan Goal 2 (Deliver enduring and essential water resource solutions through collaboration with partners and stakeholders), Objective 2a (Deliver integrated, sustainable, water resources solutions). The lead for the Comprehensive Systems Approach is Dr. Kathleen D. White of the Institute for Water Resources. The senior Program Manager is Dr. Gary W. House, CECW-CE.

This report represents work completed by the Incremental Changes to USACE Systems Project Delivery Team. The team consists of Manroop Chawla, Installations Division (CN), Construction Engineering Research Laboratory (CERL), Engineer Research and Development Center (ERDC), USACE; Larry Canter, Canter Associates, Inc. (dba Environmental Impact Training); and Carl Thomas Swor, subcontractor to Environmental Impact Training. This report was developed under Contract No. W9132T-09-C-0021. Manroop Chawla was the Project Manager.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The Commander and Executive Director of ERDC is COL Kevin J. Wilson, and the Director of ERDC is Dr. Jeffery P. Holland.

Executive Summary

The need for an integrated, comprehensive systems approach was demonstrated by the tragic events of Hurricanes Katrina and Rita in 2005. The U.S. Army Corps of Engineers (USACE) embarked on a program for incorporating lessons learned from those events, directing the focus of making decisions away from individual, isolated projects to the collective evaluation of all components within an interdependent system. This approach also requires a shift from local or immediate solutions to regional or long-term solutions with broader, more diverse ramifications. A comprehensive systems approach requires the capability to perform rigorous, well-documented, and disciplined analyses of the cumulative impacts of incremental changes over time, as well as evaluations of the incremental decisions over the system life cycle to prevent an accumulation of small changes that have disproportionate, unintended consequences.

The reality is that incremental changes (ICs) have been occurring since the USACE, and the Nation itself, were founded. ICs are often made to fulfill an identified need or to correct a perceived deficiency in laws, policies, or regulations. Whether major or minor, these changes interact to evolve and shape USACE missions, and collectively they influence project decision-making. Such changes produce both intended as well as unintended consequences. ICs also occur as unplanned, seemingly independent actions and events. One of the more recent and devastating examples of how both types of incremental changes accumulate and interact was well documented in the *Decision-making Chronology for the Lake Pontchartrain and Vicinity Hurricane Protection Project* report (Woolley and Shabman 2008) describing the series of events before, during, and after the one-two punches of Hurricanes Katrina and Rita in 2005.

A retrospective examination of numerous documents, both internal and external to the USACE, revealed the need for formal recognition of incremental change processes and incorporation of such in USACE guidance. Further, mechanisms for planning and analyzing the consequences of incremental changes, similar to analyzing project alternatives and their effects, is needed to ensure that future changes are well designed and contribute to meeting the goal of “Developing comprehensive, sustainable and

integrated water resource solutions through collaboration with regions, States, local entities, and other Federal agencies.”

This report is a review of current USACE institutional requirements and the initiation of a program to integrate incremental change considerations into pertinent documents focused on water resources planning and operation, maintenance, and evaluation activities for both new and continuing projects. The phrase “incremental changes” implies periodic or continuing small to large changes in development activities over time; such activities can influence hydrologic, geomorphic, ecologic, social, and economic conditions in localized areas, at the watershed level, or in a regional context. Further, as societal demands change and the Nation’s priorities evolve, the myriad of laws, policies, and procedures employed in planning and operating USACE projects are changing to reflect national values.

1 Introduction

The concept of incremental change for the USACE has commonly been implied through the use of terms such as revision, modification, amendment, supersede, and change. The Incremental Changes Project (ICP) examines how incremental changes are important to describe, understand, and identify many sources and types of incremental changes that collectively influence USACE project decision making.

1.1 Seminal events

The one-two punch of Hurricanes Katrina and Rita in August and September 2005 proved calamitous to a vast swath of the U.S. Gulf Coast across Louisiana, Mississippi, Alabama, Florida, and Texas. In the immediate aftermath of Hurricane Katrina, the Secretary of Defense directed the Army to enlist the National Academy of Sciences to conduct a thorough review of levees and floodwalls in place in New Orleans on 29 August 2005. Further, a special review of the decision chronology related to hurricane protection in New Orleans was also commissioned. One conclusion of the resulting chronology report was: ... “As future protection of the Gulf Coast is planned, it must be recognized that the vision set forth in any plan will necessarily change during implementation in response to new information, changing costs, stakeholder values, and agency missions, policies, and budget priorities” (Woolley and Shabman 2008, p 6–20). This conclusion implies the need to address historical, current, and anticipated incremental changes in water resources planning. Lessons from this review and other investigations are now being activated through the USACE Campaign Plan (formerly the Actions for Change initiative), which represents a new direction for the USACE in terms of how it plans, decides on, and then implements water resources management programs and projects.

1.2 USACE Campaign Plan

The USACE Campaign Plan provides the USACE vision and mission statements as follows (USACE 2009a, p 3):

- “USACE Vision - A GREAT engineering force of highly disciplined people working with our partners through disciplined thought and action to deliver innovative and sustainable solutions to the Nation’s engineering challenges.

- USACE Mission - Provide vital public engineering services in peace and war to strengthen our Nation's security and energize the economy and reduce risks from disasters. USACE performs several functions accompanying this mission as a Direct Reporting Unit (DRU) of the Army."

Both the vision and mission statements imply the inclusion of incremental changes in water resources planning and project evaluation. Further, several functions accompany the USACE mission. Among these are three that are particularly relevant to this Incremental Changes Project; they include (U.S. Department of the Army 2007, p 20):

- "Managing and executing Civil Works and environmental programs under Title 33 USC and other applicable laws." This implies compliance with laws such as the Water Resources Development Acts (WRDAs) and Corps regulations and other guidance related to water resources planning.
- "Developing comprehensive, sustainable and integrated water resource solutions through collaboration with regions, States, local entities, and other Federal Agencies." The Corps' emphasis on watershed-level planning and collaboration with various stakeholder groups is supportive of this function; further, the emphasis encourages the inclusion of incremental change considerations in project planning and evaluation.
- "Administering certain laws in the United States to protect and preserve the navigable waters and related resources, such as wetlands." The Corps' emphasis on compliance with the Clean Water Act and its various features illustrates this function. Further, incremental changes can influence water flow regimes and quality, thus also invoking this function relative to incorporating such changes in planning.

The USACE Campaign Plan also delineates four goals and associated objectives. Of these, Goal 2, along with three of its four objectives, provides an impetus for this Incremental Changes Project. Goal 2 is to "deliver enduring and essential water resource solutions through collaboration with partners and stakeholders." Specific objectives under this goal include (USACE 2009a, p 5):

- "Objective 2a: Deliver integrated, sustainable, water resources solutions.
- Objective 2b: Implement collaborative approaches to effectively solve water resource problems.
- Objective 2c: Implement streamlined and transparent regulatory processes to sustain aquatic resources."

Further explanation of Objective 2a states (USACE 2009a, p 11): “The Corps will deliver a more holistic approach to solving water resources challenges that effectively considers the broad variety of economic, social, and environmental goals and constraints through the creation of enabling mechanisms to support existing organizational core competencies in collaboration with internal and external partners. Enabling mechanisms include improving of water resources policies, regulations, processes, procedures and methods that adapt to emerging trends and national priorities; sharing best practices and lessons learned throughout and across communities of practice (i.e. planning, engineering, construction, project management, programs, operations); and enhancing and support strong capabilities and competencies to facilitate delivery. This objective deals with implementing updated planning guidance and policy, realizing regional integration goals and concepts (communities of practice, centers of expertise, regional business centers), streamlining/ adapting processes to improve effectiveness and efficiency, developing programs to improve technical capabilities and programs designed to facilitate and support the delivery of products to achieve authorized purposes.”

1.3 This study

The interpretation of Objective 2a above includes three phrases that are relevant to the consideration of incremental changes in water resources planning. The first, “holistic approach,” suggests that a total or all-inclusive perspective is needed. As a result, if incremental changes could influence planning and operation, they should be included in these processes. The second phrase is “...improving of water resources policies, regulations, processes, procedures, and methods.” A key focus of this study is related to identifying needs for changes in existing regulations and other documents or the development of new regulations and policies. Attention will also be given to the development of specific wording and text for necessary changes. The final phrase is “...implementing updated planning guidance and policy.” Again, strategic planning for such implementation will be included in this study.

We examined five examples of recent influences on the situational context related to incremental changes, including, first, several National Research Council reports of USACE water resources planning needs that have indirectly encompassed incremental changes in recommendations associated with project evaluations and more holistic, systems-based studies at river basin levels. Second, the decision chronology report on the New Orleans Hurricane Protection Project provides detailed examples of the impor-

tance of considering incremental changes in project design and operational situations. Third, a review of the USACE six-step planning process was used to illustrate how incremental changes could be incorporated into each of the steps, which would provide immediate benefits to water resources project planning. Fourth, consideration was given to how the USACE Digest of Water Resources Policies and Authorities, which is currently in revision, could be used to directly introduce incremental changes in specific mission areas. Finally, an examination of the Council on Environmental Quality's 11-step cumulative effects assessment process indicated that it could be easily adapted to enable the immediate incorporation of incremental changes in NEPA (National Environmental Policy Act) documentation.

The three primary USACE mission areas (inland navigation, flood damage reduction, and ecosystem restoration) were also selected for detailed review of the opportunities for incorporating incremental changes in project planning and operation. A total of 65 Engineer Regulations (ERs), Engineer Technical Letters (ETLs), Engineer Circulars (ECs), Engineer Pamphlets (EPs), and Engineer Manuals (EMs) were systematically reviewed. Some of these documents are cross-cutting and apply to all mission areas, whereas others are focused on the three selected areas. Each document was reviewed in accordance with a Document Review Form, and for each a determination was made as to whether or not action was recommended using the tiered scheme shown in Table 1. In addition, each Level 1 to 4 document was assigned a priority based on the narrowness or broadness of the applicability of the revised document, the time-sequenced availability of incremental-change-related information that could be used in the revised document or a supplemental document (EC, ETL, EP, etc.), and the amount of effort required. Shorter time periods prior to initiation of the changes in a document generally reflect a high priority.

Table 1. Tiered scheme used to characterize type of update required to incorporate the concept of incremental changes.

Level	Description
Level 0	It is not necessary that incremental changes (ICs) be addressed in this document
Level 1 (least extensive)	ICs should be introduced and added, as appropriate, throughout the document, or an ETL should be issued clarifying and explaining ICs in relation to the document.
Level 2	This document should be reorganized so that ICs become a central feature, or a corollary EC or EP could be produced that addresses the dynamic influence of ICs on the topic of this document.
Level 3	Rather than modifying this document, it is recommended that a new document specifically focused on monitoring the influences of ICs be developed; the new document could be an EM, or it could be an EP or ETL to support (or supplement) the existing EM.
Level 4 (most extensive)	Because of the importance of the document and the potential extent of necessary modifications or original writing, it is recommended that a work group be established to study the concerns and recommend solutions to identified problems beyond the scope of this PDT.

2 Overview of Incremental Changes Project

This research study, the Incremental Changes Project (or ICP), is part of Theme 1 of the Actions for Change (AFC) Program. This program has been subsumed within the Corps' 2009 Campaign Plan. As noted above, Theme 1 emphasized the use of a comprehensive systems approach for water resources planning. This chapter contains an overview of the ICP, the delineation of four objectives associated with the ICP, a brief listing of the potential Corps-wide benefits that could result from the ICP, and a summary of the structure of this report.

2.1 Focus of the ICP

The ICP emphasizes the review of current Corps institutional requirements and the initiation of a program to integrate incremental change considerations into pertinent documents focused on water resources planning and operation, maintenance, and evaluation activities associated with both new and continuing projects. In addition, the ICP is developing technologies to support a comprehensive evaluation capability for assessing how incremental changes affect USACE projects on a watershed and regional basis. Such capability will enable visualization of past, ongoing, and future watershed changes that impact project performance (such as accumulated degradation of facilities due to cyclic use, or exposure to unprecedented operating conditions as encountered during Hurricane Katrina). In addition to a forward-looking systems approach, a retrospective analysis can also be useful. For example, the concept of periodic reviews of completed Civil Works projects, and the use of such findings in Corps project planning and management, was advocated in a recent National Research Council study (Panel on Methods and Techniques of Project Analysis 2004, pp 110–111).

2.2 Study objectives

The overall ICP study includes four major objectives; one part of the first objective forms the basis for this report. The four overall objectives include:

- **Objective 1:** Review existing policies, methods, and technologies that support assessment of incremental change over time in the watershed, region, or system. Define future states for these policies, methods, and

technologies and identify knowledge and technology gaps. Further, develop recommendations for the Actions for Change Program within the 2009 Campaign Plan, including the use of post-authorization evaluations. Finally, identify and prepare required legislative, policy, process, and guidance updates. (Note: A comprehensive review will be conducted of Corps-related and other environmental laws, policies, regulations and guidelines that either could have influenced incremental changes in projects, or influenced the assessment (interpretation) of the significance of resultant environmental changes. This report, referred to hereafter as the “institutional review” report, has been produced and subjected to peer review). This report represents the completion of the “policies review” portion.

- **Objective 2:** Develop and test an analytical prototype framework to support a comprehensive evaluation capability for incremental changes to USACE projects on a watershed, regional, or system basis. Further, based on these findings, identify knowledge and technology gaps and needed improvements and further testing of the prototype.
- **Objective 3:** Prepare guidance related to potential new Engineer Regulations (ERs), Engineer Pamphlets (EPs), Engineer Circulars (ECs), Engineer Manuals (EMs), and Engineer Technical Letters (ETLs), or to appropriate modifications of existing relevant ERs, EPs, ECs, EMs, and /or ETLs. A detailed strategy for preparing such guidance will be developed as part of this objective.
- **Objective 4:** Conduct an information dissemination and review program for the key deliverables from Objectives 1 through 3. This program should be carried out both within and external to the Corps, including to other governmental agencies and stakeholder groups. Detailed tasks related to this objective will be subsequently developed.

2.3 Applicability of findings

The target user community for products of the PDT is the Civil Works Program of the USACE, with an additional subcommunity being the Regulatory Program. The following benefits would be expected to accrue to professionals within the Civil Works Program:

- User-friendly and tested incremental change guidance and information would be made available to environmental planners and others within USACE Divisions and Districts.
- Case studies related to two or three ongoing planning studies could be used as a model for preparing subsequent incremental change studies at the watershed, region, or system level.

- Because incremental change is a vital component in the disciplined analysis of cumulative effects, the deliverables should enhance the accomplishment of impact studies, or portions thereof, focused on cumulative effects assessment.
- Improvements in public safety and water resources infrastructure should occur in the coming years. In addition, professionals within the Regulatory Program could use information on incremental change concepts in examining historical and current activities in geographical areas being subjected to multiple permit applications. Further, the results of specific incremental change studies could be used in addressing impact considerations in permit decision-making.

2.4 Structure of this report

Following the initial two chapters, this report has nine additional chapters and 11 appendices:

- Chapter 3 – The Broad Nature of Incremental Changes – defines the term incremental changes and highlights key observations associated with the definition.
- Chapter 4 – Selection of Mission Areas and Documents to be Reviewed – delineates the rationale for selecting three mission areas (inland navigation, flood damage reduction, and ecosystem restoration) to illustrate how incremental changes could be incorporated in regulations and related documents. Examples of types of projects associated with the three mission areas are also noted. Further, the chapter addresses the process used to identify, select, and review pertinent regulations and other documents.
- Chapter 5 – Review of Situational Context and the Resultant Findings – summarizes key features of five sources of information related to incremental changes. The sources include National Research Council (NRC) publications, the decision chronology for New Orleans hurricane protection, the USACE Planning Guidance Notebook and Digest of Water Resources Policies and Authorities, and the Council on Environmental Quality's (CEQ's) 11-step cumulative effects assessment process. The final subchapter highlights specific applications and observations related to incremental changes.
- Chapter 6 – Review of Cross-Cutting Documents and the Resultant Findings – summarizes the reviews of 19 ERs and other documents that have applicability to the three mission areas. The documents were systematically reviewed and one of five possible recommendation levels was assigned to each. The rationale for the assignment of one of the

- four action levels (Levels 1 through 4) is described for the 11 documents for which changes are recommended. Further, information is included on an overall work prioritization. Finally, key observations from the reviews are noted.
- Chapter 7 – Review of Inland Navigation Documents and the Resultant Findings – summarizes the reviews of 14 documents (seven ERs and other documents and seven EMs) that have applicability to inland navigation. The documents were systematically reviewed and recommendation levels were assigned. The rationale for the assignments is described for the documents receiving recommendations for Levels 1 through 4. In addition, the work prioritization is also explained. Finally, key observations from these document reviews are highlighted.
 - Chapter 8 – Review of Flood Damage Reduction Documents and the Resultant Findings – summarizes the systematic reviews of 24 documents related to flood damage reduction. Two document groupings were utilized: 16 ERs and other documents and eight EMs. Recommendation levels were assigned to all 24 documents. The 15 documents receiving recommendation levels from 1 to 4 are briefly described, along with their proposed work prioritization within a 12-month time frame. Finally, key observations from these reviews are delineated.
 - Chapter 9 – Review of Ecosystem Restoration Documents and the Resultant Findings – includes reviews of ecosystem restoration changes in Water Resources Development Acts from 1976 to 2007, along with summaries of the features of six Policy Guidance Letters (PGLs). Both of these reviews were used to identify examples of incremental changes resulting from laws and policies. In addition, six documents related to ecosystem restoration (four ERs and two EPs) were reviewed and recommendation action levels were assigned. Changes are recommended for four documents, and the rationale for this recommendation is provided, along with information on their work prioritization schedule. Finally, key observations from these reviews are noted.
 - Chapter 10 – Summary and Recommendations – summarizes the action recommendation levels for 38 documents receiving assignments of Levels 1 to 4. Further, a listing of the time-related prioritization for the 38 documents is included. Because of the large number of documents (38), strategies are described for accomplishing the needed changes.
 - The “Literature Cited” section includes citations to the references in Chapters 1 through 10.
 - Appendices A–K – contain reviews for the 65 documents actually subjected to systematic review, as well as historical information related to inland navigation and flood damage reduction projects.

3 The Broad Nature of Incremental Changes

The PDT recognized early in this study that the term “incremental change” is a recent addition to the USACE vernacular. However, the idea of incremental change has existed throughout the history of the USACE. Many commonly used terms can be captured under the heading of incremental change. Some examples of these terms include revision, modification, amendment, supersede, change, etc. This chapter includes two subsections. The first represents a broad concept statement that includes examples of incremental changes that have or could occur and that could influence planning and operations and evaluations associated with new and/or completed projects. The second subsection highlights key observations derived from the first subsection.

3.1 Concept of incremental changes

USACE systems encompass several types of missions. Among the most prevalent are flood damage reduction projects/systems, deep draft and inland waterway navigation projects/systems, and ecosystem restoration projects/systems. Individual projects can range from singular and localized endeavors within specific watersheds to regional systems composed of multiple projects and purposes involving a single large or even several watersheds. The phrase “incremental changes” implies periodic or continuing small to large changes over time that can influence hydrologic, geomorphic, ecologic, social, and economic conditions in localized areas, at the watershed level, or in a regional context. Incremental changes also include the numerous modifications to legislation, policy, and regulation that have been implemented (or may be implemented in the future) that have individually and collectively contributed to determine how USACE projects are planned, evaluated, designed, constructed, operated, and modified at any point in time. As societal demands change and the Nation’s priorities evolve, the myriad of laws, policies, and procedures employed in formulating, evaluating, selecting, designing, constructing, and operating USACE projects reflect national values at some point along the continuum of ongoing incremental change.

Historical and current incremental changes can result from the influences of local to regional economic development initiatives, including land use changes to accommodate housing and various social demands of increasing populations. For example, runoff hydrographs can be altered in both

timing and flows as a result of urbanization. New laws and resultant USACE policies and regulations can also initiate changes in environmental requirements and emphases (e.g., incorporation of resource sustainability), as well as funding requirements for project sponsorship (e.g., local sponsors and cost-sharing). Design changes may also occur as a result of new policies reflecting changes in historical practices (e.g., design flood and the introduction of risk considerations in both flood damage reduction and costs).

Historic incremental changes to existing projects and conditions must be evaluated when planning new project designs and operations. Unanticipated incremental changes in site, regional, or institutional contexts often occur during the life cycle of projects, and such occurrences may create the need for design or operational modifications to projects as a means of maintaining or enhancing their continued functionality. Accordingly, project designs and operational plans should be seen as dynamic endeavors and should be periodically evaluated and modified as appropriate. This approach combines situational awareness with an adaptive management strategy.

It is essential that the likelihood of incremental changes be anticipated and appropriately considered in initial project designs and operational planning for new projects as well as for potential modifications to existing projects. Such future incremental changes may be influenced by foreseeable economic development and land use changes, new or revised legislation and policies, and/or the collective effects of multiple changes in hydrologic, ecologic, economic, and other conditions resulting from actions by other public agencies and private interests. Further, new themes in water resources project planning and operation can contribute both to incremental changes and improved project management. Examples of new themes include issuance of the Chief of Engineers' Environmental Operating Principles, adaptive management, consideration of resource sustainability, and climate change.

3.2 Key observations related to the concept

Three key observations related to the above definitional concept of incremental changes can be noted. The first is that the concept can be applied to all mission areas of the USACE; that is, it is not limited to inland navigation, flood damage reduction, and ecosystem restoration projects. Second, for water resources planning in a given watershed or sub-watershed, the planning process can be improved by considering histori-

cal, current, and future incremental changes in the identified study area. Such considerations will likely require retrospective analyses to identify historical and current changes and prospective analyses to designate potential future changes. Finally, the numerous examples above illustrate that multiple project, development, and policy decisions can be initiators of incremental changes.

4 Selection of Mission Areas and Documents to be Reviewed

This chapter describes the selection of three USACE mission areas to serve as examples of how incremental changes have affected their associated project planning. The three areas include inland navigation, flood damage reduction, and ecosystem restoration. Examples of types of projects associated with these areas are included in the second sub-section. The final sub-section addresses the process used for the systematic selection and review of pertinent regulations and other documents. The results from the use of this process are contained in Chapters 6 through 9.

4.1 The three selected mission areas

As listed in the Digest of Water Resources Policies and Authorities (EP 1165-2-1), the overall Civil Works mission areas of the USACE include (USACE 1999a):

- **Navigation** – The Federal interest is established by the Commerce Clause of the Constitution, and subsequent court decisions, defining the right to regulate navigation and improvement of the navigable waters. Inland navigation and deep draft navigation are considered separately due to legislative constraints and USACE policies, including but not limited to the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G). The ICP includes specifically authorized, continuing authorities, and dredging in support of inland navigation programs/ projects.
- **Flood Damage Reduction (FDR)** – This mission was first established in the Flood Control Act of 1936. For the ICP, the program includes specifically authorized, continuing authorities, and other FDR programs/projects.
- **Shore Protection** – The Federal interest in shore protection was legislatively established by Section 2 of the River and Harbor Act in 1930. This mission area has undergone numerous modifications since its inception.
- **Stream Bank Erosion Control** – The Federal interest in stream bank erosion control is primarily limited to bank stabilization measures required as components of flood damage reduction, navigation, and other water resource development and in serious cases affecting the general public welfare.

- **Hydroelectric Power** – Through various statutes, Congress has directed consideration of hydroelectric power in water resource development plans.
- **Recreation** – Section 4 of the Flood Control Act of 1944, as amended, authorized the Chief of Engineers “... to construct, maintain, and operate public park and recreational facilities at water resource development projects under the control of the Secretary of the Army, and to permit the construction, operation, and maintenance of such facilities....”
- **Water Supply and Quality Management** – National policy, defined by Congress, has been developed over a number of years and is still being clarified and extended by legislation. This policy recognizes a significant but declining Federal interest in the long-range management of water supplies and assigns the financial burden of supply to users.
- **Environmental (Ecosystem) Restoration and Protection** – Ecosystem restoration is one of the primary missions of the Civil Works Program. The purpose of Civil Works ecosystem restoration activities is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Ecosystem restoration efforts involve a comprehensive examination of the problems contributing to the system degradation and the development of alternative means for their solution. The intent of restoration is to partially or fully reestablish the attributes of a natural, functioning, and self-regulating system. Ecosystem restoration includes specifically authorized and continuing authorities programs/projects, and it is a rapidly evolving mission within the USACE.
- **Aquatic Plant Control** – Section 104 of the River and Harbor Act of 1958 (Public Law 85-500), as amended, and Sections 103, 105, and 712 of the Water Resources Development Act of 1986 (Public Law 99-662) authorize the USACE to cooperate with other Federal and non-Federal (usually state) agencies in comprehensive programs for the control of obnoxious aquatic plants.
- **Regulatory** – Until 1968, the primary thrust of the USACE Regulatory Program was to protect navigation. As a result of new laws and judicial decisions, the USACE 1968 permit regulations required for the first time a full public interest review involving a balancing of the favorable impacts against the detrimental impacts as the primary basis of permit decisions.
- **Support for Others** – SFO is USACE-performed work funded by non-Department of Defense (DoD) Federal agencies or by state, local, tribal and foreign governments, international organizations, and the private sector.

- Civil Works Research and Development – The Civil Works (CW) Research and Development (R&D) Program supports USACE's performance of CW missions and business programs. The CW R&D Program addresses CW mission-related problems to enhance the performance of all USACE elements. Typically programs focus on the highest priority problems.

While each of the above twelve missions has experienced incremental changes through a series of decisions over time, three high-priority missions (Inland Navigation, Flood Damage Reduction, and Ecosystem Restoration) were selected by the PDT as the focus for the ICP. These three missions will be used to illustrate how past incremental changes have affected USACE projects. Considerations by the PDT in making the determination of which missions to select were:

- The missions should represent broad areas of involvement in which most USACE Districts would have studied or completed projects.
- They should be primary or high-priority mission areas.
- Substantial amounts of information should be available for these missions, including historical information and a variety of current projects.
- The missions should have experienced incremental changes in the past and will be likely to continue to do so in the future (i.e., missions that experience continuing but evolving needs, or emerging needs).
- The missions should represent a broad spectrum to illustrate the importance and effects of incremental changes.
- Inland navigation is the oldest Civil Works mission of the USACE, also, there is considerable need for infrastructure planning as much of the infrastructure is at or near the end of its design life; thus additional planning for repair, rehabilitation, and/or replacement of existing infrastructure is expected.
- Flood damage reduction is expected to continue to evolve toward the utilization of risk-based approaches in planning and project evaluation.
- Ecosystem restoration represents a growth area for USACE involvement.
- Extensive documentation of the lessons learned from Hurricanes Katrina and Rita serve to illustrate the importance of incremental changes to existing and new USACE projects in all three of these mission areas.

4.2 Types of projects associated with the mission areas

The USACE accomplishes its inland navigation mission through a combination of capital improvements and the operation and maintenance of ex-

isting projects. Capital improvement activities include the planning, design, and construction of new or modernized navigation projects. These activities are performed for the navigation of shallow draft (equal to or less than 14-foot draft) and deep draft (greater than 14-foot draft) vessels on both inland waterways and harbors, along with coastal and lake ports, harbors, and channels. The focus here is on inland navigation.

The general navigation features of inland navigation projects include channels; jetties or breakwaters; locks and dams; and basins or water areas for vessel maneuvering, turning, passing, mooring or anchoring incidental to transit of the channels and locks. Also included are dredging, dredged material disposal areas, and the use of dredged material for ecosystem restoration. Special navigation-related programs include removal of wrecks and obstructions, snagging and clearing for navigation, drift and debris removal, bridge replacement or modification, and mitigation of project-induced damage (USACE 2000, pp 3-1 to 3-4).

Flood damage reduction projects can include both structural and non-structural measures. Structural measures refer to physical modifications designed to reduce the frequency of damaging levels of flood inundation. Structural measures include dams with reservoirs, dry dams, channelization measures, levees, walls, diversion channels, pumps, ice-control structures, and bridge modifications. Section 73 of the WRDA of 1974 requires consideration of nonstructural alternatives in flood damage reduction studies. They can be considered independently or in combination with structural measures. Nonstructural measures reduce flood damages without significantly altering the nature or extent of flooding. Damage reduction from nonstructural measures is accomplished by changing the use made of the floodplains or by accommodating existing uses to the flood hazard. Examples are flood proofing, relocation of structures, flood warning and preparedness systems (including associated emergency measures), and regulation of floodplain uses (USACE 2000, pp 3-10). Executive Order 11988 (Flood Plain Management) of 1977 is related to the planning and implementation of nonstructural measures.

The USACE has incorporated ecosystem restoration as a project purpose within the Civil Works program in response to the increasing national emphasis on environmental restoration and preservation. Ecosystem restoration features can be considered as single-purpose projects or as part of multiple-purpose projects along with navigation, flood protection and other purposes, wherever those restoration features improve the value and

function of the ecosystem. A wide range of improvements to ecosystem functions is possible, including, but not limited to, using dredged material to restore wetlands; restoring floodplain function by reconnecting oxbows to the main channel; providing for more natural channel conditions including restoring riparian vegetation, pools and riffles and adding structure; modifying obstructions to fish passage including dam removal; modifying dams to improve dissolved oxygen levels or temperature downstream; removing drainage structures and or levees to restore wetland hydrology; and restoring conditions conducive to native aquatic and riparian vegetation (USACE 2000, pp 3-23 and 3-24).

4.3 Process for selection and review of regulations and other documents

The primary focus of this report is on the findings from a systematic review of pertinent USACE regulations and other documents. Accordingly, a systematic process was used to select regulations and other institutional documents for review in relation to their need for inclusion of incremental changes information. Specific emphasis was given to identifying pertinent ERs, EPs, ECs, PGLs, EMs, and ETLs. Specific chronological lists of four of the six types of documents (ERs, EPs, ECs, and PGLs) were identified from the USACE Planning Community of Practice website and the Planner's Library contained therein. Lists for the remaining two types (EMs and ETLs) were identified via Google. All procured lists were on the general USACE Headquarters website.

Following the electronic procurement of a given list, e.g., ERs, the title of each document was reviewed to determine its potential relevance to the topic of incremental changes (referred to here as cross-cutting documents) or to projects within the three mission areas. If a document was deemed to be potentially relevant, it was downloaded into specific files for the six types of documents. A total of 125 documents were included in the six files: 46 EMs, 42 ERs, 22 EPs, 9 PGLs, and 3 each for ECs and ETLs. These documents within the six files were then copied onto CDs and provided to the three key PDT members (Chawla, Canter, and Swor).

The 125 documents were then divided, by topic, into five categories: (1) cross-cutting relative to the three mission areas; (2) cross-cutting relative to water quantity and quality management for the three mission areas; (3) cross-cutting relative to responses to incremental changes; (4) ERs, EPs, ECs, PGLs, and ETLs that specifically address projects in one of the three mission areas; and (5) EMs that specifically address projects in one of the

three mission areas. One of the three PDT members was assigned as the primary reviewer for each of the 125 documents, with a second member asked to review the findings.

To provide a consistent basis for each review, a Document Review Form (DRF) was created. The following topical headings or questions were incorporated on each DRF:

- Document (citation)
- Description (of document)
- Are incremental changes (ICs) mentioned?
- Why should ICs be addressed?
- Recommendation (five categories were considered and one was selected, along with the inclusion of appropriate notes).

The five recommendation categories were:

- Level 0: It is not necessary that incremental changes (ICs) be addressed in this document; thus, no recommendation for their inclusion is made.
- Level 1: ICs should be introduced and added, as appropriate, throughout the document, or an ETL should be issued clarifying and explaining ICs in relation to the document.
- Level 2: This document should be reorganized so that ICs become a central feature, or a corollary EC or EP could be produced that addresses the dynamic influence of ICs on the topic of this document.
- Level 3: Rather than modifying this document, it is recommended that a new document specifically focused on monitoring the influences of ICs be developed; the new document could be an EM, or it could be an EP or ETL to support (or supplement) the existing EM.
- Level 4: Because of the importance of the document and the potential extent of necessary modifications or original writing, it is recommended that a work group be established to study the concerns and recommend solutions to identified problems beyond the scope of the ICP.

Copies of the document reviews are contained by topical groupings in Appendices A through D, F and G, and I through K.

Finally, a priority order was assigned to each document receiving a Level 1, 2, 3, or 4 recommendation as shown in Table 1. The focus was on the initiation of work to accomplish the recommendation level. Factors considered in the prioritization included the narrowness or broadness of the applica-

bility of the revised document, the time-sequenced availability of IC-related information that could be used in the revised document or a supplemental document (EC, ETL, EP, etc.), and the relative extent of the effort required to accomplish the recommendation level. The overall results of the priority order for all five categories of documents are presented in Chapter 10 (Summary and Recommendations).

5 Review of Situational Context and the Resultant Findings

This chapter addresses IC-related information, or inferences thereto, in one broad topical category, three USACE documents, and one guidance document from the Council on Environmental Quality (CEQ). The broad category is focused on National Research Council (NRC) publications. The USACE documents include a Hurricane Protection Decision Chronology (HPDC) report for the Lake Pontchartrain and New Orleans area (Woolley and Shabman 2008); one ER referred to as the Planning Guidance Notebook (ER 1105-2-100; April 2000); and one composite EP on Water Resources Policies and Authorities (EP 1165-2-1; July 1999). The CEQ guidance document is focused on an 11-step process for addressing cumulative effects in NEPA compliance documents (Council on Environmental Quality 1997). The final subsection address key observations related to these situational context examples for addressing ICs.

5.1 Situational context from National Research Council publications

This chapter summarizes information from six relatively recent NRC reports on selected recommendations for improving water resources planning within the USACE. The possibilities for incorporating incremental change analyses within planning are noted as appropriate for each report. This review was conducted early in the ICP in order to provide a context for the study. Further, additional NRC publications are identified for future review.

5.1.1 New directions in water resources planning

In 1999 a NRC study committee promulgated several recommendations related to new directions and needed improvements in the USACE water resources planning process. The following recommendations are directly or indirectly related to the need to address historical, current, and future incremental changes in project planning (Committee to Assess the U.S. Army Corps of Engineers Water Resources Planning Procedures 1999, pp 4–8):

- The Federal Principles and Guidelines (USACE 2008b) should be thoroughly reviewed and modified to incorporate contemporary analytical techniques and changes in public values and Federal agency programs

- (pp 4–5). Contemporary techniques could include attention to incremental changes. Also, the USACE initiated a review and updating process for the Principles in the fall 2008; the process is ongoing as of the fall 2009. It is anticipated that the Guidelines will be subsequently addressed. Such reviews and updating are anticipated to include specific reference to incremental changes.
- To promote efficient plans and projects across river basin systems, the USACE should use the watershed or river basin, estuarial region, and coastal unit as the basic spatial units in water project planning, when and where they are appropriate and circumstances allow. Such spatial scales can help account for downstream effects of flood damage reduction projects (p 5). The use of hydrologically appropriate scales can aid in identifying upstream incremental changes that could affect existing or planned local projects and in forecasting downstream consequences of such changes when coupled with other historical or future downstream incremental changes over time.
 - As the USACE has embraced ecosystem restoration as a primary mission area, it has been realized that additional life science and environmental engineering professionals are needed. Accordingly, the Committee recommended that the USACE should continue to strengthen its staff expertise in the biological and ecological sciences (p 6). Staff expansion in these substantive areas would enhance the USACE's ability to effectively identify and evaluate incremental changes in project planning related to all USACE mission areas, including the selected areas of inland navigation, flood damage reduction, and ecosystem restoration.
 - Because of numerous uncertainties related to the costs and consequences of large-scale water resources projects, the Committee recommended that such projects should include long-term monitoring capability. To the extent that long-term monitoring is critical to a project's successful management, including environmental management, the costs of monitoring should be part of overall project costs (p 6). Further, it was also recommended that attention be given to the adaptive management of large-scale projects; adaptive management means that project planning does not end when construction is finished, but rather is an ongoing, iterative process that makes appropriate adjustments as environmental and social conditions change (p 7). Numerous uncertainties are associated with both identifying incremental changes and forecasting their effects. Monitoring and adaptive management could be used to reduce such uncertainties and plan more effective modifications for existing projects, as well as more efficient

designs for new projects. These positive outcomes would be especially beneficial for enhancing the understanding of natural systems when planning large-scale ecosystem restoration projects. Subsequent to these recommendations from NRC, Congress passed the Water Resources Development Act (WRDA) 2007. Section 2039 of that act directed the Secretary to ensure when conducting a feasibility study for a project (or component of a project) for ecosystem restoration that the recommended project includes a plan for monitoring the success of the ecosystem restoration. On 31 August 2009, the USACE issued guidance for implementing this provision (USACE 2009c).

- The USACE should strive to improve and further develop analytical methods for valuing the environmental benefits/detriments associated with its water projects. A substantial, sustained effort will be required to develop a standardized set of tools, including benefit-transfer models and programs, to help quantify environmental benefits and costs associated with its restoration, flood damage reduction, and navigation projects (p 7). Further, such tools can aid in project evaluation. For example, the benefits of flood damages avoided should be included in the benefit-cost analysis of all flood damage reduction projects, including all nonstructural projects (p 8). New analytical methods could aid USACE planners as they incorporate incremental change considerations in project planning and associated economic evaluations. For example, Section 219 of the WRDA of 1999 directed the Secretary of the Army to calculate benefits for nonstructural flood damage reduction projects using methods similar to those used in calculating the benefits of structural projects and further directed the Secretary to avoid double-counting benefits in these projects.

5.1.2 Background for following five NRC reports

In Section 216 of the 2000 WRDA, a request was made that the NRC conduct several studies related to modernizing the policies, procedures, and methods used by the USACE in their water resources planning. Consequently, the Water Science and Technology Board (WSTB) of the NRC appointed a multi-member Committee to Assess the U.S. Army Corps of Engineers Methods of Analysis and Peer Review for Water Resources Project Planning. Four Panels and a Coordinating Committee were subparts of the overall Committee, and each of these five groups provided leadership in the development of five NRC reports. The reports are:

- Panel on Peer Review – Review Procedures for Water Resources Project Planning, 2002.

- Panel on Methods and Techniques of Project Analysis – Analytical Methods and Approaches for Water Resources Project Planning, 2004.
- Panel on Adaptive Management for Resource Stewardship – Adaptive Management for Water Resources Project Planning, 2004.
- Panel on River Basin and Coastal Systems Planning – River Basins and Coastal Systems Planning Within the U.S. Army Corps of Engineers, 2004.
- Coordinating Committee – U.S. Army Corps of Engineers Water Resources Planning: A New Opportunity for Service, 2004.

5.1.3 Recommendations from NRC reports

The following subsections address selected recommendations from the five NRC reports that have direct or indirect relationships to the consideration of incremental changes in project planning. Specific citations for these five reports are included in the Literature Cited (p 81).

5.1.3.1 Document Review Procedures. The Panel on Peer Review dressed the need for an independent, external review process for major reconnaissance and feasibility reports and NEPA (National Environmental Policy Act) compliance documents (Panel on Peer Review 2002). The Panel recommended that such a process be established to ensure the quality and credibility of such decision documents (p 4).

In response to this report, and other public laws, in 2008 the USACE issued Engineer Circular (EC) 1105-2-410 (USACE 2008d). The key feature of the EC was an Independent External Peer Review (IEPR) process. Review policies are addressed along with four types of review: District Quality Control (DQC), Agency Technical Review (ATR) (replaces the Independent Technical Review process that was internal to the USACE), IEPR, and policy and legal compliance reviews. The conduct of each type of review is also described. In general, the Panel recommendation, along with the EC, will be supportive of the incorporation of substantive and scientifically based incremental change considerations in USACE's decision documents. Accordingly, documentation of incremental changes should be included throughout the USACE's planning and operation and maintenance processes.

5.1.3.2 Analytical Methods and Approaches. Three recommendations by the Panel on Methods and Techniques of Project Analysis have direct or indirect relevance to incremental change considerations and their incorpo-

ration in the planning process (Panel on Methods and Techniques of Project Analysis 2004, pp 5–9):

- The 1983 Principles and Guidelines should be revised to better reflect contemporary management paradigms, analytical methods, legislative directives, and social, economic, and political realities. The new planning guidance should apply to water resources implementation studies and similar evaluations carried out by all Federal agencies with water resources responsibilities (p 5). Even if a comprehensive revision is not accomplished in an expedient manner, the USACE should draft a revision to its Planning Guidance Notebook (ER 1105-2-100) and utilize it as appropriate. As noted above, a revision of the Principles within the Principles and Guidelines is in progress. These revisions, as well as subsequent ones to the Guidelines, are anticipated to support the inclusion of incremental changes considerations throughout the USACE planning process.
- The USACE does not systematically review outcomes of its water projects. This lack of retrospective, or “ex post,” reviews represents missed opportunities to better understand how demands on water projects have changed over time, the relative strengths and weaknesses of planning methods, and how project operations have (or have not) changed to meet changing conditions. Accordingly, the Panel recommended that periodic reviews of completed projects should be a routine part of USACE water project planning and management (p 7). Further, the Panel noted that the USACE has planning authorities that allow for existing project operations to be reviewed and adjusted. The two authorities that the USACE uses most frequently for these purposes are a “Section 216” authority from the 1970 Flood Control Act and a “Section 1135” authority from the 1986 Water Resources Development Act (p 111). The 216 authority is often used for re-studies, while the 1135 authority is typically associated with ecological restoration projects. To place this recommendation in context, it can be noted that current projects may be operated under their design conditions; however, incremental changes within the watershed, or within regulations or guidelines, or associated with societal needs, may necessitate either modifications in the project or its operations or both. Accordingly, “ex post” evaluations could lead to better informed decisions related to both existing projects and new projects under consideration in other locations.
- The USACE should strengthen its methods and approaches in the areas of systems engineering aspects of water resources, impacts of risk and uncertainty analysis on planning, and the integration of engineering

methods of analysis with ecosystem restoration planning. Engineering methods include hydraulics and hydrology models, hydrodynamics and sediment transport models, geotechnical models, and structural models (p 90). Ecosystem restoration models can include conceptual models, habitat models, and contaminant transport and fate models. Environmental impact models can include some of the above as well as the development of specific models to address local or regional conditions. Part of this strengthening should also include the development of updated design manuals that better reflect contemporary methods and theories. These manuals should be used as general guidance rather than as “cookbooks” (p 9). The inclusion of incremental change considerations in project planning and operations may necessitate modifications of existing models, or even the development of blended hydrodynamic and ecosystem models. Such models could be initiated via conceptual models that can be developed into quantitative modeling tools. The USACE now requires that models used in planning studies be certified through a credible review process (USACE 2005a, 2008c).

5.1.3.3 Adaptive Management in Water Resources Planning. Adaptive management, including the requisite monitoring of engineering and environmental indicators, along with stress factors (e.g., barge traffic levels in navigation projects), actually began as a natural resources management paradigm in the 1970s. Since then, it has been used as a tool to aid decision-making in both existing and new water resources projects. This tool can be used to decrease uncertainties and enhance learning relative to influencing factors in water resources systems. The Panel for this study noted that “...adaptive management promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process” (Panel on Adaptive Management for Resource Stewardship 2004, pp 2–3). In this regard, the topic of incremental changes is new, so a learning process will be required in relation to including it in water resources planning.

The Panel also indicated that “...adaptive management may be particularly suited to large, complex ecosystem restoration projects, which entail large degrees of risk and uncertainty, multiple, and changing objectives, and phased components” (p.5). Further, the Panel noted that “...adaptive management entails a spectrum of approaches. These range from passive pro-

grams, which focus on monitoring and evaluating outcomes from a particular policy choice, to more formal and rigorous active adaptive management, which designs management actions to test competing models of system behavior so that models can be improved for future decision making” (p 5).

One specific recommendation from this NRC study that has relevance to the incorporation of incremental change considerations in project planning (Panel on Adaptive Management for Resource Stewardship 2004, pp 6, 10) is:

Post-construction evaluations should be a standard for the inclusion of adaptive management within Corps projects and systems (p 6). Key continuing authorities for such evaluations include Section 216 from the 1970 Flood Control Act, and Section 1135 from the 1986 WRDA (p.10). With careful planning, such evaluations could be used to systematically examine the incremental effects of land use and policy changes within project watersheds. This information could also be used to plan necessary operational changes or other modification in existing projects, and to develop both current and future designs for new projects which take into account the influence of incremental changes.

5.1.3.4. River Basins and Coastal Systems Planning. A systems approach to water resources planning was highlighted in this report. To illustrate, it was stated that (Panel on River Basin and Coastal Systems Planning 2004, pp 1–2):

Successful water project planning and evaluation in a multi-objective, multi-stakeholder environment requires an integrated systems approach capable of a balanced evaluation of all relevant issues (e.g., hydrologic, geomorphic, ecologic, social, and economic) over relevant scales of space and time. Such an approach is required to identify unintended consequences, multiple stressors, and cumulative effects and to evaluate trade-offs among competing objectives such that the true costs and benefits of a project may be examined within a context that incorporates the interests of all those with any substantial stake.

“Multiple stressors” in the above quote implies that numerous actions or changes, including incremental changes, can create stresses on USACE projects and the purposes for which they were built or are being planned. One example is the dynamic nature of runoff changes in a watershed that is subjected to multiple decades of land conversion from agricultural or

forestry practices to urbanization. The term “cumulative effects” denotes that multiple infrastructure and water resources projects, as well as industrial and urban developments, can contribute to similar effects on indicators of common natural resources and human communities. In certain instances, the consequences of incremental changes can be major contributions to reductions in the sustainability of common resources.

This Panel also noted that the USACE has made policy changes and “adopted an integrated watershed or regional perspective and environmental stewardship as primary institutional objectives” (p 2). The integrated watershed policy represents a change away from the USACE’s recent focus on local cost-shared projects. To some extent, it represents a return to regional water resources planning, which characterized the period from the 1950s to 1980s. Environmental stewardship is a relatively new focus in USACE planning; in fact, this change requires increased attention and commitment to environmental protection and management. Both of these policy changes will require incremental approaches to their accomplishment; hence they reflect examples of incremental changes resulting from policy alterations.

A systems approach also requires a multi-disciplinary perspective. In this regard, planning teams should be composed of engineers, economists, ecologists/biologists, environmental scientists, planners, social scientists, and cultural resources specialists. Further, and appropriately, the Panel pointed out that:

Human activities that alter the function of various systems are not limited to activities planned and implemented by the Corps. State and local projects and land-use practices can have a significant impact on watersheds and coastal systems and on how these systems respond to Corps-implemented projects (p 20).

The multiple activities and related stressors noted above should be considered as potential contributors to cumulative effects on species, resources, and human communities. Such activities will likely be both spatially and temporally dispersed in specific watersheds and regional study areas. In fact, some of these activities may be subjected to water-related permit requirements. To illustrate, the USACE regulatory program is frequently engaged with local projects and land use practices. Accordingly,

... a fuller accounting of the potential impacts of these permitted activities in any systems analysis may offer greater insight into the cumulative

effects of such activities within a given watershed or coastal system and hence, lead to more effective project design and implementation (p 21).

These quotes and comments indicate how important it is that the USACE recognize that activities by others can cause or contribute to historical, current, or future incremental changes in local to regional areas. Accordingly, it is particularly important for the USACE to incorporate the consideration of incremental changes in water resources planning.

Finally, the Panel on River Basins and Coastal Systems Planning included two recommendations that are directly or indirectly related to incremental changes:

- “The Corps’ planning guidance should be modified to provide Corps planners with contemporary analytical techniques necessary for integrated systems planning on large scales within river basin and coastal systems. Guidelines for identifying all relevant factors affected by a water project and their spatial and temporal scales, and standards for a balanced evaluation of economic, social, and environmental factors, should be updated and expanded to a level of detail comparable to current standards for traditional benefit-cost analysis of economic objectives of a project” (pp 5–6).
- “The Corps should ensure that all project plans include an assessment of how the project fulfills the Corps’ commitment to environmental stewardship. The cumulative effects of each project, together with other past and future human activities in the same river basin or coastal system, should be consistently evaluated for all projects” (pp 7–8).

Acceptance and implementation of both of these recommendations would enhance the consideration of incremental changes in water resources project planning. For example, the first recommendation notes the need to identify all relevant factors, and incremental changes are examples of such factors. The second recommendation highlights the cumulative effects of all human activities, again including incremental changes and associated effects that can result from these activities. Finally, attention to stewardship and environmental sustainability requires the allocation of attention to incremental changes.

5.1.3.4 New Opportunity for Service. The NRC report produced by the Coordinating Committee represents the final document from the overall Committee to Assess the U.S. Army Corps of Engineers Methods of Analysis and Peer Review for Water Resources Project Planning. The report re-

flects the task of the Coordinating Committee to “...produce a synthesis document that includes the panel’s findings and recommendations and provides advice on implementation of the panels’ recommendations,” as well as to “...identify overarching themes, issues, or recommendations that emerge from the panels’ studies, including possible future roles for the Corps in sustainable management of coastal and inland waters in the United States” (Coordinating Committee 2004, p 2).

The importance of addressing an aging infrastructure composed of existing projects was highlighted, as was dealing with a backlog of authorized (but unfunded) new projects or modifications to existing projects. As time elapses in a backlog situation, additional incremental changes can occur; such recent changes should be considered and acted on when new projects or modifications to existing ones are being finalized prior to construction. Further, calls for reallocation of reservoir storage and flows were also mentioned by the Committee. Finally, it was noted that these issues are also being faced by other Federal water resources agencies such as the Bureau of Reclamation and state and local governments who may be cost-sharing in Federal projects. Accordingly, these other agencies and levels of government need to be made aware of the importance and implications of addressing incremental changes.

A feature of the Coordinating Committee report is the concept of “portfolio planning.” In this context, the Committee included the following comments:

... in the near term, the Corps should center its planning activities on “portfolio planning.” The term “portfolio” is used in the Corps’ own planning documents, and its meaning is extended herein to consider both the water and the related land resources of the nation’s rivers and coastal areas (natural capital), as well as the physical water management infrastructure in these river and coastal systems. The term “planning” includes analytical approaches and decision-making processes that govern investment and management strategies. Portfolio planning does not mean that there is no longer a need for new investment, but it does mean evaluating new investments in the context of the condition and operations of existing physical infrastructure. Portfolio planning does not mean that the Corps program will no longer serve traditional navigation and flood risk management needs, but it does mean that these needs can no longer primarily determine how past project investments are operated and new project investments evaluated (p 4).

One implication of portfolio planning is the need to be all-inclusive relative to both new projects and modifications of existing ones. Such holistic planning and evaluation should encompass identification and consideration of past, present, and potential future incremental changes within local areas, pertinent watersheds, and the overall region.

The Coordinating Committee report also included three conclusions or recommendations related to either the three types of projects (missions) addressed here or to the conduct of studies where incremental changes could be highlighted (Coordinating Committee 2004):

- “The Corps’ primary environmental (restoration) mission should be to restore hydrologic and geomorphic processes in large river and coastal systems” (p 5).
- “A new study authority should be enacted and structured according to the following principles, which will help effect portfolio planning within the Corps—one principle is that it should focus on existing Corps-built infrastructure (both single projects and systems) and related water and land resources in determining when operational changes, project decommissioning, or new project investments would yield economic or environmental improvements of national significance” (pp 6–7).
- “A program of continuing regional assessments can serve as the basis for setting portfolio planning program priorities. These regional assessments, which could include comparisons of water issues between regions and longitudinal studies in select regions, should be periodically conducted in order to help identify key water resources issues of Federal-level importance” (p 9).

Although not specifically stated above, it is reasonable to note that historical, current, and future incremental changes should be included within the implementation of each of the three conclusions/ recommendations.

5.1.4 Other NRC publications to be reviewed

While the above-described reports from 2002 and 2004 were driven by requirements in Section 216 of WRDA 2000, other publications over the last decade also have specific relevance to this ICP. These publications will be subsequently reviewed. Examples of pertinent publications include:

- *New Strategies for America’s Watersheds* (Committee on Watershed Management 1999)
- *Compensating for Wetland Losses Under the Clean Water Act* (Committee on Mitigating Wetland Losses 2001)

- *Managing the Columbia River: Instream Flows, Water Withdrawals, and Salmon Survival* (Committee on Water Resources Management, Instream Flows, Water Withdrawals, and Salmon Survival in the Columbia River Basin 2004)
- *Valuing Ecosystem Services – Toward Better Environmental Decision-Making* (Committee on Assessing and Valuing the Services of Aquatic and Related Terrestrial Ecosystems 2005)
- *Regional Cooperation for Water Quality Improvement in Southwestern Pennsylvania* (Committee on Water Quality Improvement for the Pittsburgh Region 2005)
- *Colorado River Basin Water Management: Evaluating and Adjusting to Hydroclimatic Variability* (Committee on the Scientific Bases of Colorado River Basin Water Management 2007)
- *Tools and Methods for Estimating Populations at Risk from Natural Disasters and Complex Humanitarian Crises* (Committee on the Effective Use of Data, Methodologies, and Technologies to Estimate Subnational Populations at Risk 2007)
- *Understanding Multiple Environmental Stresses: Report of a Workshop* (Committee on Earth-Atmosphere Interactions: Understanding and Responding to Multiple Environmental Stresses 2007)
- *Hydrologic Effects of a Changing Forest Landscape* (Committee on Hydrologic Impacts of Forest Management 2008)
- *Urban Stormwater Management in the United States* (Committee on Reducing Stormwater Discharge Contributions to Water Pollution 2008)
- *Ecological Impacts of Climate Change* (Committee on Ecological Impacts of Climate Change 2008)
- *Mapping the Zone: Improving Flood Map Accuracy* (Committee on FEMA Flood Maps 2009)

Several NRC publications have addressed the Upper Mississippi River–Illinois Waterway planning study. The following publications will be reviewed to determine their relevance to this ICP, including serving as a case study:

- *Inland Navigation System Planning – The Upper Mississippi River–Illinois Waterway* (Committee to Review the Upper Mississippi River–Illinois Waterway Navigation System Feasibility Study 2001)
- *Review of the U.S. Army Corps of Engineers Restructured Upper Mississippi River – Illinois Waterway Feasibility Study* (Committee to Review the Corps of Engineers Restructured Upper Mississippi River–Illinois Waterway Feasibility Study 2004a)

- *Review of the U.S. Army Corps of Engineers Restructured Upper Mississippi River – Illinois Waterway Feasibility Study: Second Report* (Committee to Review the Corps of Engineers Restructured Upper Mississippi River-Illinois Waterway Feasibility Study 2004b)
- *Water Resources Planning for the Upper Mississippi River and Illinois Waterway* (Committee to Review the Corps of Engineers Restructured Upper Mississippi River-Illinois Waterway Draft Feasibility Study 2005)

Additional NRC publications that have relevance here are related to Hurricane Katrina and its damages and aftermath. Seven such reports will be reviewed for relevance to this PDT:

- *Opportunities for Water Security Research: The Aftermath of Hurricane Katrina – Letter Report* (Committee on Water System Security Research 2005)
- *Structural Performance of the New Orleans Hurricane Protection System During Hurricane Katrina: Letter Report* (Committee on New Orleans Regional Hurricane Protection Projects 2006b)
- *Second Report of the National Academy of Engineering/National Research Council Committee on New Orleans Regional Hurricane Protection Projects* (Committee on New Orleans Regional Hurricane Protection Projects 2006a)
- *Third Report of the National Academy of Engineering/National Research Council Committee on New Orleans Regional Hurricane Protection Projects* (Committee on New Orleans Regional Hurricane Protection Projects 2006c)
- *Environmental Public Health Impacts of Disasters: Hurricane Katrina, Workshop Summary* (Goldman and Coussens 2007)
- *Fourth Report of the National Academy of Engineering/National Research Council Committee on New Orleans Regional Hurricane Protection Projects: Review of the IPET Volume VIII* (Committee on New Orleans Regional Hurricane Protection Projects 2008)
- *The New Orleans Hurricane Protection System: Assessing Pre-Katrina Vulnerability and Improving Mitigation and Preparedness* (Committee on New Orleans Regional Hurricane Protection Projects 2009)

Finally, three other NRC publications related to the loss, protection, and restoration of coastal lands in Louisiana may have relevance to this ICP. The relevance may range from general incremental changes information to

the specific consideration of such changes in ecosystem restoration projects. The three publications are:

- *Drawing Louisiana's New Map: Addressing Land Loss in Coastal Louisiana* (Committee on the Restoration and Protection of Coastal Louisiana 2006)
- *First Report from the NRC Committee on the Review of the Louisiana Coastal Protection and Restoration (LACPR) Program* (Committee on the Review of the Louisiana Coastal Protection and Restoration – LACPR – Program 2008)
- *Final Report from the NRC Committee on the Review of the Louisiana Coastal Protection and Restoration (LACPR) Program* (Committee on the Review of the Louisiana Coastal Protection and Restoration – LACPR – Program 2009)

5.2 Situational context from the decision chronology for New Orleans hurricane protection

On 29 August 2005, Hurricane Katrina's storm surge overwhelmed many of the levees and floodwalls for greater New Orleans designed and constructed by the USACE, collectively known as the Lake Pontchartrain & Vicinity Hurricane Protection Project (LP&VHPP). The result was a human tragedy—more than 1,600 people killed or missing and presumed dead with over 1,250 confirmed deaths in Louisiana alone. In economic terms, the flooding from Katrina represents the costliest natural disaster in U.S. history. Direct flood damages to residential, non-residential, and public properties and infrastructure in greater New Orleans approached \$28 billion, with further indirect economic effects and long-lasting socioeconomic disruption to the region.

In the immediate aftermath of the tragedy, the Secretary of Defense directed that the U.S. Army enlist the National Academy of Sciences and National Research Council to conduct a thorough review of the engineering aspects of the performance of the levees and floodwalls in place in New Orleans on 29 August 2005.

Examples of the resultant reports are now available (Committee on New Orleans Regional Hurricane Protection Projects 2006a–c, 2008, and 2009).

In addition, the USACE concurrently commissioned a study of the decision chronology of the LP&VHPP over the 50-year period from 1955 to 2005.

Highlights of the chronology's findings as related to decision timelines, funding, and policies will be noted here. Some significant Congressional, judicial, and USACE Headquarters decisions included (Woolley and Shabman 2008, p ES-9):

- 1955 – Congress authorizes the USACE to conduct hurricane protection studies.
- 1959 – Congress establishes Federal (70%) and local (30%) cost sharing for hurricane protection projects.
- 1966 – Congress authorizes the LP&VHPP Barrier Plan.
- 1976 – Project EIS challenged in Federal court lawsuit.
- 1979 – Federal injunction lifted for all parts of the project other than the barrier complexes.
- 1981 – Preliminary planning document shows that the High Level Plan is less costly to complete and less damaging to the environment.
- 1985 – The LP&VHPP Reevaluation Study recommends the High Level Plan and it is approved under the discretionary authority of the Chief of Engineers.
- 1991 – Congress directs the USACE to favorably consider the parallel protection plan for all of the outfall canals in New Orleans (WRDA of 1990).
- 1992 – Congress directs the USACE to implement parallel protection and funded the work at 70% Federal (WRDA 1992).

Examples of chronological project decisions associated with the design parameters and benchmarks for the LP&VHPP included (Woolley and Shabman 2008, p ES-13):

- 1960 – National Hurricane Research Project (Report 33) sets Standard Project Hurricane (SPH) and compares SPH with the Standard Project Flood (SPF).
- 1963 – Interim Survey Report for the LP&VHPP set SPH as the design hurricane (SPH windspeed and central pressure remained unchanged for design purposes).
- 1966 – The LV&VHPP was authorized by Congress (a post-authorization change added 1 to 2 feet to all structure designs based on hurricane Betsy windfields).
- 1969 – Hurricane Camille occurred and New Orleans District comparisons indicated that Camille's wind speeds and central pressures were more severe than the Project Maximum Hurricane (PMH) – the meteorological worst-case scenario; however, no design height updates were made.

- 1980 – NOAA Technical Report NWS 23 provided new SPH and PMH parameters.
- 1985 – A Reevaluation Report provided new SPH parameters; however, the original SPH parameters were still used for design purposes.
- 1986 – The New Orleans District froze the benchmark elevations of previously constructed works to NGVD 29 (National Geodetic Vertical Datum 29 feet). This datum was related to one established for the area in 1929.
- 1993 – The USACE's Coastal Engineering Research Center developed an Advanced Circulation model for the evaluation of storm surges; however, the model findings were not used to revise design features of the LP&VHPP.

In addition, several decisions were made on outfall canal designs in relation to their influence on levees in the area. WRDA 1990 and WRDA 1992 both included directions for the USACE to implement parallel protection plans for outfall canals in the area. The plans were largely based on I-type floodwalls. Cost considerations influenced the various designs and their evaluation.

Based on detailed reviews of the above decision chronologies and others related to the LP&VHPP, Woolley and Shabman (2008, pp ES-16 to ES-18) concluded the following:

- “Concerns about project cost growth, constrained Federal and local budgets, delays in project completion, and the possible need for reauthorization if major changes were proposed, help to explain District decisions to construct the project according to original designs and datum benchmarks.” This implies that incremental changes associated with design factors, as well as maintaining NGVD 29, were not adequately recognized over the multi-decade planning period.
- “There was no Corps organizational process that required and provided funding for a continuing assessment of project performance capability during the post-authorization implementation period.” With new information and analytical techniques that became available over the 50-year design and implementation period, the influence of numerous incremental changes could have been evaluated.
- “There is no evidence in the project record indicating that project engineers believed that the decisions made would threaten engineering reliability.” This reflection suggests that the various potential influences of incremental changes were not adequately recognized or evaluated.

- “The only recurring organizational provision for systematically reporting the expected performance capability of the project was the annual Budget Justification Sheet (BJS).” However, the BJSs did not delve into the subject of incremental changes.

Finally, based on their extensive study, Woolley and Shabman (2008) made two recommendations for future projects. First, they noted the importance of sharing knowledge between the USACE, all stakeholder groups, and other pertinent Federal, state, and local agencies. Second, they recognized the need for flexibility and adaptation in project planning, design, and implementation, which will be more important in study areas that have or will experience multiple types of incremental changes. Such changes can increase future uncertainties, hence the need for an adaptive design and management approach.

5.3 Situational context from Planning Guidance Notebook

The USACE’s ER 1105-2-100, which is referred to as the *Planning Guidance Notebook* (PGN), provides overall direction by which Civil Works projects are formulated, evaluated, and selected for implementation (USACE 2000, p 1-1). This large volume includes four chapters and eight appendices. The introductory chapter (Ch. 1) is followed by chapters on planning principles (Ch. 2), the USACE’s Civil Works mission areas (Ch. 3), and the types of studies and reports and their related procedures (Ch. 4). The first two appendices include references (App. A) and public involvement and coordination information (App. B). Appendix C addresses environmental compliance relative to the National Environmental Policy Act (NEPA) and other related laws such as the Endangered Species Act. Appendix D highlights procedures related to economic evaluation of projects, as well as social considerations and their consequences.

Appendix E of the PGN focuses on various Civil Works missions and evaluation procedures. Nine mission areas are included: navigation, flood damage reduction, hurricane and storm damage prevention, ecosystem restoration, hydroelectric power, recreation, water supply, multiple purpose projects, and major rehabilitation studies. As appropriate, procedures for National Economic Development (NED) benefit evaluations are addressed. The final three appendices address the continuing authorities program (App. F), planning reports and programs (App. G), and review and approval of decision documents (App. H).

The PGN also describes a six-step planning process for water resources planning (USACE 2000). The process follows the one contained in the “Principles and Guidelines” document from 1983 (U.S. Water Resources Council 1983). The 1983 document was applicable to water resources project plans by the Civil Works Program of the USACE and similar plans by the U.S. Bureau of Reclamation, National Resources Conservation Service, and Tennessee Valley Authority.

The six steps of the planning process are listed in Table 2. While there are many facets associated with the six steps, each of them should include the consideration of incremental changes. The potential relevance of such changes for each step is also summarized in Table 2. Based on the information in Table 2, the following conclusions can be identified:

- Incremental changes can be incorporated in the six-step planning process. In fact, such changes are likely to have been, and will continue to be, a part of the process; however, the specific term “incremental changes” may not have been specifically included.
- Incremental changes can influence the features and characteristics of resultant plans, so they should be a factor in selecting the recommended plan.
- A single prescriptive approach cannot be identified for addressing incremental changes. In contrast, creativity will be needed for effectively identifying, evaluating, and including such changes in the planning process.

A review of the PGN is included in Appendix A. A specific recommendation as to how incremental changes should be incorporated in the PGN is included in Section 6.

Table 2. Summary of six-step planning process and relevance of the consideration of incremental changes.

Step	Relevance of Incremental Changes
1 Identifying Problems and Opportunities	Problems to be addressed via the planning process should be summarized. Such problems could include the consequences of historical changes in watershed land use on surface runoff patterns and water quality. Other changes could occur from human population increases and the resultant demands on water supply and allocations. Opportunities refer to potential plans and projects that could be developed to address the identified problems (needs). Another task involves defining the study planning objectives and constraints that can guide the efforts to solve the problems and achieve the opportunities. This task could include the development of clearly defined specified objectives related to both managing incremental changes and responding to increased water demands resulting from such changes.
2 Inventory and Forecast	This step requires inventories of critical resources related to the needs and opportunities. Such resources can include both biophysical and man-made environments (such as water flow regimes, water quality, aquatic ecology, and land uses) and demographics, cultural resources, and social and economic characteristics. Information on historical and current conditions should be summarized, along with forecasts for future without-project conditions for

Step	Relevance of Incremental Changes
	these environmental features over the period of analysis. Incremental changes resulting from changes in land use, laws, regulations, policies, and societal preferences, and their associated consequences, should be integral parts of Step 2. Further, the consequences could be central to the quantification of both problems (needs) and opportunities, and the delineation of specific goals (objectives) for a developed project or plan.
3 Formulation of Alternative Plans	<p>Alternative plans can consist of systems of structural and nonstructural measures, strategies, or programs that have been developed in response to specific objectives. The multiple features of such plans can be focused on addressing specific needs and objectives. Accordingly, certain features could be directed to reducing the undesirable consequences of types of incremental changes, as well as enhancing the quality of both the biophysical and man-made environment. Examples related to industrial or urban developments in a watershed include the use of Best Management Practices, green belts, density limitations of developments, etc. Ecosystem restoration projects could be used to promote the recovery and enhancement of ecologically valuable riparian and aquatic habitats. Local area cultural resources protection programs and memoranda of agreements could also be included as mitigation measures for the slow deterioration of cultural resources on USACE lands.</p> <p>In addition, each alternative plan must be evaluated in terms of its completeness, efficiency, effectiveness, and acceptability. Finally, and in accordance with Section 904 of WRDA 1986, each plan is to be formulated and evaluated relative to the enhancement of national economic development, protecting and restoring the quality of the total environment, societal well-being, prevention of loss of life, and preservation of cultural and historical values. These factors could be used to reduce a larger list of plans to a smaller number to be subjected to more detailed evaluation.</p>
4 Evaluating Alternative Plans	<p>Each plan subjected to detailed comparative evaluation must include forecasted with-project conditions for the critical resources noted in Step 2. The forecasts should encompass the planning horizon. The with-project forecasts should account for the influence of historical to current incremental changes, as well as such changes anticipated to occur in the future. The second task under Step 4 involves comparing each action alternative's with-project condition with the without-project condition (no action alternative), and documenting the differences between the two. In this regard, one would anticipate incremental changes to differ between each alternative, so their influence on the features and consequences of each alternative would also differ. The third task involves the characterization of the beneficial and adverse effects of each alternative, including the contributions of incremental changes to each effect. Further, the effects are to be classified by magnitude, location, timing, and duration. The final task is to identify the alternative plans that will be subjected to Steps 5 and 6 in the process. These plans should already include appropriate consideration of incremental changes.</p>
5 Comparing Alternative Plans	<p>The plans brought forward from Step 4 (including the no-action plan) are to be compared against each other relative to their outputs and beneficial and adverse effects. The comparisons should include monetary and non-monetary benefits and costs. Identification and documentation of trade-offs between plans are required to support the final recommendations. The effects include those identified during the evaluation phase and any other significant effects identified in Step 5. This comparison step is related to the evaluation step; however, in Step 5 each plan (including the no-action plan) is compared against each other and not against the without-project condition. The output of Step 5 shall be a ranking of plans. Further, the comparisons and rankings should incorporate information on incremental changes based on Steps 2 through 4 above.</p>
6 Select a Plan	<p>This step involves the recommendation for a single alternative plan. Based upon Steps 2 through 5 above, the recommended plan should include appropriate consideration of historical, current, and future incremental changes. In the process of determining the recommended plan, consideration should be given to four types of included plans: the National Economic Development (NED) Plan, the National Ecosystem Restoration (NER) Plan, the Combined NED/NER Plan, and the Locally Preferred Plan (if applicable). Each of these four plans should encompass appropriate incremental changes.</p>

5.4 Situational context from Digest of Water Resources Policies and Authorities

This digest form of the USACE Water Resources Policies and Authorities, EP 1165-2-1, contains 24 chapters and six appendices. The first 11 chapters are broad and applicable across the USACE mission areas. Examples of their topical coverage include the Federal responsibility in water resources (Ch. 1); general policies related to environmental laws, executive orders, and topics (Ch. 3); planning studies (Ch. 5); project cost sharing and repayment (Ch. 6); construction (Ch. 10); and operations, maintenance, and project management (Ch. 11). Chapters 12 through 20 address the USACE mission areas, including three chapters related to the mission areas addressed here, namely, navigation (Ch. 12), flood damage reduction (Ch. 13), and environmental restoration and protection (ecosystem restoration) (Ch. 19). Chapter 21 highlights the USACE Regulatory Program. The six appendices include two of relevance here: Appendix B on legislation pertinent to the USACE water resources program and Appendix C on executive orders related to the program.

Although EP 1165-2-1 is being updated at this time, it is still useful for a variety of purposes, including examination of broad incremental changes. The following are examples referring to incremental changes:

- The dynamic nature of Federal policy is described in Chapter 1. This change is related to legislative enactments that reflect both long- and short-range national priorities and require progressive adaptation. Rigid policies are undesirable when dealing with resources that affect the well-being of people and that have broad economic, environmental, and social implications. Changing technology and public priorities require flexible policies and informed leadership to meet urgent needs and to assure the welfare of future generations.
- The tendency has been for Congress to gradually increase Federal responsibility in response to needs of the times. Some water resources project purposes were originally established through specific legislation. Others were established as a result of repetitive Congressional authorization of projects containing resource purposes incidental to the “primary” project purposes. Legislation pertinent to the water resources program of the USACE is listed in Appendix B of EP 1165-2-1.
- The Water Resources Development Act (WRDA) of 1986 is the legislative landmark of major current significance. In it, the Congress comprehensively reestablished and redefined, by purpose, the Federal interest in water resources development, and has, in recognition of the

- limitations on Federal financial resources in an era of persistent budgetary deficits, instituted requirements for proportionately greater non-Federal cost sharing in USACE projects.
- During the 1970s there was a qualitative change in public policy toward resource planning and development, spurred by the recognition that this Nation's natural resources are both interrelated and finite. Considerations other than economic efficiency evolved. Among others, this legislation includes:
 - The Clean Water Act of 1977 (Public Law 95-217)
 - Water Resources Development Act of 1976 (Public Law 94-587)
 - Water Resources Development Act of 1974 (Public Law 93-251)
 - River and Harbor and Flood Control Act of 1970 (Public Law 91-611)
 - National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190).
 - Administrative policy has developed gradually but continuously over the years to implement laws and to encompass the growth of economic and social need and changing technology.
 - Federal courts clarify and define the responsibilities and limitations placed on the USACE Civil Works activities by Federal statutes and the Constitution. Judicial decisions have affected Civil Works policies in several major areas; for example, basic authority to construct or operate projects, administrative practices and required factors of consideration in project construction and operation (including environmental factors), and the scope and application of regulatory authorities.
 - In recent years the judicial effect on policy has been most pronounced in matters of administrative procedures, particularly those involving public participation in decision-making and related environmental questions. The provisions of the NEPA have been applied by the courts virtually to the whole scope of the planning, construction, and operation of water resources projects, resulting in numerous changes in agencies' basic procedures. Because of this increased judicial scrutiny, which occurred in the early 1970s, individuals and groups affected by present or proposed projects will have a continued opportunity to use the courts to test the propriety and application of administrative procedures.

As noted above, this EP is undergoing revision; however, possible changes to the EP are not reflected in the current review. Because this EP provides important documentation of historical changes, amendments, modifications, clarifications, etc., on virtually every aspect of USACE missions, the

revised EP should specifically discuss such changes as being incremental changes. An extensive review of the current EP is in Appendix A of this report. A specific recommendation for addressing incremental changes in the current EP is described in Section 7.

5.5 Situational context from cumulative effects assessment process

Cumulative Effects Assessment (CEA) has been receiving increased attention in the NEPA compliance process since the publication of the Council of Environmental Quality's (CEQ's) 1997 guidance on this subject (Council on Environmental Quality 1997). The accepted CEQ definition of cumulative effects (impacts) is as follows:

Cumulative impact (effect) is the impact (effect) on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts (effects) can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7).

The definition uses the term “incremental impact.” This term relates to the consequences of a planned action (project) on environmental features. The word “incremental” suggests a change from prior impacts on the features. In contrast, and as demonstrated in Section 3, the term “incremental change” is broader in scope. Further, such incremental changes should be part of a CEA study. To illustrate this point, Table 2 includes the 11-step CEA process promulgated by CEQ (Council on Environmental Quality 1997, p 10). The right column of Table 3 includes illustrations of how incremental changes could be incorporated in each step. Consideration of such changes should be based on the location and extent of their consequences in relation to the selected Valued Ecosystem Components (VECs) subjected to incremental changes from the proposed action.

Table 3. Summary of 11-step CEA process and relevance of the consideration of incremental changes.

Step	Relevance of Incremental Changes
1 Identify the significant cumulative effects issues associated with the proposed action and define the assessment goal	A beginning activity would be to define the direct and indirect effects of the proposed action (and alternatives). Early cursory reviews of the status of various resources, ecosystems, and human communities (can also be referred to as Valued Ecosystem Components – VECs) should reveal where degradation is occurring. Such degradation could be the result of historical and current incremental changes. This information could be used to identify cumulative effects issues of concern and to establish study goals.
2 Establish the geographic scope for the analysis	Spatial boundaries for the VECs subject to direct and indirect effects should be delineated. Additional considerations should include the spatial extent of the VEC, the potential influence of incremental changes, and the effects of other actions within the boundaries.
3 Establish the time frame for the analysis	Historical to current incremental changes and their influence on selected VECs should be considered in establishing the historical reference point and trends in the conditions of the VECs. Further, anticipated future incremental changes, both with and without the project, should be considered, along with other factors and future actions, in establishing the projected time boundary.
4 Identify other actions (past, present, and future) affecting the VECs of concern	Incremental changes within the three time periods should be identified and considered in terms of their relative contributions to the conditions of the selected VECs. Further, other identifiable specific actions and their relative contributions to effects on VECs should also be delineated.
5 Characterize the selected VECs identified in scoping in terms of their response to change and capacity to with-stand stresses	The selected VECs will exhibit variability in their carrying capacity; further, they could be particularly susceptible to stresses that are caused by incremental changes. Accordingly, more detailed information on the types of effects from incremental changes, as well as other actions, may need to be examined.
6 6: Characterize the stresses affecting the VECs and their relationship to regulatory thresholds	As noted in Step 5, some incremental changes may cause degradation in the quality characteristics of selected VECs. These degrading conditions should be evaluated in relation to both regulatory thresholds and professional knowledge and experience. Other actions and stresses should also be noted and evaluated.
7 Define a baseline (historical reference point) condition for the selected VECs, as well as trends to the current time	The initial condition and trends in the VECs should be described. Further, the influence of incremental changes on these temporally-related conditions should be noted.
8 Identify the important cause-and-effect relationships between human activities and the selected VECs	The effects of other past, present, and future actions on the VECs anticipated to be affected by the proposed action should be addressed. Further, incremental changes that have affected these same VECs should be identified. Attention should also be given to common pathways of effects; for example, habitat degradation or loss, or environmental transport via airborne or waterborne routes.
9 9: Determine the magnitude and significance of cumulative effects on	All influencing actions, as well as incremental changes, should be evaluated in terms of their relative contributions to cumulative effects on the selected VECs. Such contributions could be addressed qualitatively, quantitatively, or relatively. Consideration should be given to historical, current, and future conditions. The significance of the

Step	Relevance of Incremental Changes
the selected VECs	cumulative effects should be determined based on CEQ's definition of significance coupled with the consideration of the sustainability conditions for the selected VECs.
10 Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects	If significance or potential significance is determined, VEC-related mitigation measures may be required for the incremental effects of the proposed action. Further, other local actions and incremental changes which are also contributing to cumulative effects on specific VECs may also need to be addressed via cooperative arrangements with pertinent governmental entities and the private sector.
11 Monitor the cumulative effects of the selected alternative and adapt management	For significant cumulative effects on specific VECs, as well as effects that are of concern because of their potential significance, local to regional monitoring programs should be established. The monitoring results could be used to adaptively manage the proposed action and established control measures for other actions and pertinent incremental changes. Collaboration with other pertinent governmental agencies and the private sector may be necessary in establishing and conducting an adaptive management program.

5.6 Key observations related to examples of situational context

Five examples that are relevant to the situational context for this ICP have been described. These examples were chosen to represent both external circumstances that have focused direct or indirect attention on incremental changes, as well as two existing USACE water resources planning documents wherein guidance toward the concept of incremental changes already exists. Specifically, the following observations are noted from the five examples:

- The NRC reports that have advised the USACE on water resources planning needs have indirectly encompassed incremental changes in recommendations associated with project evaluations and more holistic systems-based studies at river basin levels. More recent reports and books related to hurricane protection in New Orleans are expected to echo similar recommendations.
- The decision chronology report on the New Orleans hurricane protection project provides detailed examples of the importance of considering incremental changes in project design and operational situations (Woolley and Shabman 2008). Numerous other factors, such as budgetary constraints, decision authorities, and collaboration and cost-sharing with stakeholder groups, were also highlighted. Specific awareness of incremental changes and their consequences would likely have improved the overall performance of the hurricane protection project.
- The PGN (ER 1105-2-100) was used to highlight the USACE's six-step water resources planning process. Specifically, Table 2 was developed to illustrate how incremental changes could be currently incorporated

into each of the six steps. Such incorporation would provide immediate benefits to water resources project planning.

- The USACE's Digest of Water Resources Policies and Authorities (EP 1165-2-1) provides useful background information on legislation, policies, and practices for water resources planning. Also useful are Chapters 12 through 20 on specific mission areas. Again, although incremental changes are not specifically mentioned, they are implied throughout this EP. Further, since this EP is currently being revised, there are existing opportunities to directly introduce incremental changes at appropriate locations.
- The final example relates to the need to address CEA in NEPA compliance documents for water resources projects. The 11-step CEA process promulgated by CEQ is displayed in Table 3 along with the potential relevance of incremental changes to each step. Again, the key observation is that the USACE can begin immediately to incorporate incremental changes in their NEPA documentation.

6 Review of Cross-Cutting Documents and the Resultant Findings

Three categories of reviewed documents cut across the three selected mission areas (inland navigation, flood damage reduction, and ecosystem restoration). The cross-cutting categories are focused on general applicability to the three mission areas, water quantity and quality management, and responses to incremental changes that are influencing existing USACE projects. A total of 21 documents were included in the cross-cutting categories.

6.1 Regulations and other documents with general applicability to the three mission areas

Table 4 summarizes the recommendations for 10 documents that have general applicability to the three mission areas. The ten documents include six ERs, two EPs, and two ECs. The completed DRFs for nine of the 10 documents are in Appendix B. Due to the overarching nature of ER 1105-2-100, its DRF was included in Appendix A. One document was assigned a Level 4 recommendation, four were assigned Level 1 recommendations, and the other five were given Level 0 recommendations. This summary information is contained in Table 5.

The prioritization order for the one Level 4 document is as follows:

- ER 1105-2-100: The *Planning Guidance Notebook* (PGN) is basic to the Corps water resources planning process. As such, it is considered as one of two overarching documents. The other overarching document is EP 1165-2-1 (*Digest of Water Resources Policies and Authorities*). The PGN includes numerous relevant features. Perhaps the most important is the description of the Corps' six-step planning process. In addition to incremental changes, several other current issues may be appropriate for addition to the PGN. Examples include environmental and resource sustainability, adaptive management, and incorporation of climate change considerations. No specific time schedule is recommended for these changes; rather, they should be grouped and addressed in one effort. It is presumed that this effort could occur beyond 12 months from the decision point for initiating document changes under this ICP.

Table 4. Summary of recommendations on eight regulations and related documents that are cross-cutting relative to the three selected mission areas.

Document	Title	Recommendation
ER 1110-2-1150	<i>Engineering and Design for Civil Works Projects</i> , 31 August 1999	Level 1
ER 1105-2-100	<i>Planning Guidance Notebook</i> , 22 April 2000	Level 4
ER 200-1-5	<i>Policy for Implementation and Integrated Application of the U.S. Army Corps of Engineers (USACE) Environmental Operating Principles (EOPs) and Doctrine</i> , 30 October 2003	Level 0
ER 200-2-2	<i>Procedures for Implementing NEPA</i> , 4 March 1988	Level 1 (Note 1)
ER 200-2-3	<i>Environmental Compliance Policies</i> , 30 October 1996	Level 0
EP 200-2-3	<i>Environmental Compliance Guidance and Procedures</i> , 30 October 1996	Level 0
ER 1130-2-540	<i>Environmental Stewardship Operations and Maintenance Guidance and Procedures</i> , 15 November 1996	Level 1 (Note 1)
EP 1110-1-16	<i>Handbook for the Preparation of Storm Water Pollution Prevention Plans for Construction Activities</i> , 27 February 1997	Level 0 (Note 2)
EC 1110-2-6065	<i>Guidance for a Comprehensive Evaluation of Vertical Datums on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects</i> , 1 July 2007	Level 1
EC 1105-2-410	<i>Review of Decision Documents</i> , 22 August 2008	Level 0
Notes:		
1. Further work on this IC Project should be completed prior to the final determination of a recommendation level; at this time, a Level 1 recommendation is appropriate.		
2. Further work on this IC Project should be completed prior to the final determination of a recommendation level; at this time, a Level 0 recommendation is appropriate.		

Table 5. Summary of recommendations for regulations and other documents related to three cross-cutting issues.

Cross-Cutting Issues	Documents Reviewed	Recommendations				
		Level 0	Level 1	Level 2	Level 3	Level 4
Applies to three selected mission areas	10	5*	4*	—	—	1
Water quantity and quality management for the three selected mission areas	4	1	—	—	3	—
Responses to incremental changes (for existing projects)	7	3**	3	1	—	—
Total	21	9	7	1	3	1

Notes:

* One of the four documents received an associated note that indicated further work on this IC Project should be completed before a final recommendation level is determined.

** One of the three documents received an associated note that indicated further work on this IC Project should be completed before a final recommendation level is determined.

The following prioritization order is proposed for the four Level 1 documents:

- ER 1110-2-1150: *Engineering and Design for Civil Works Projects*, 31 August 1999. This ER has relevance for the design of all Civil Works projects, and consideration of historical, current, and future incremental changes (ICs) should be incorporated in both engineering and design considerations. As Level 1 denotes, an ETL could be prepared to clarify and explain ICs in relation to ER 1110-2-1150. Work on such an ETL could be initiated in the near term (defined here as 3 months).
- EC 1110-2-6065: *Guidance for a Comprehensive Evaluation of Vertical Datums on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects*, 1 July 2007. This recent EC addressed issues arising from Hurricane Katrina, so it does not need immediate changes. However, consideration could be given to the development of a supporting ETL that provides examples of ICs and their relationships to vertical datums. Work on such an ETL could be initiated in the intermediate term (defined here as 3–6 months).
- ER 1130-2-540: *Environmental Stewardship Operations and Maintenance Guidance and Procedures*, 15 November 1996. While a Level 1 recommendation was made, Note 1 in Table 4 indicates that further work on this IC Project should be completed prior to the final determination of a recommendation level. Accordingly, a specific decision relative to the Level 1 recommendation could be made in 9–12 months.
- ER 200-2-2: *Procedures for Implementing NEPA*, 4 March 1988. The remarks above for ER 1130-2-540 also apply to this ER. Further, because of its age, ER 200-2-2 will likely be modified in the next several years, and ICs could be incorporated at that time.

6.2 Manuals related to water quantity and quality management for the three mission areas

Table 6 summarizes the recommendations for four documents that are related to water quantity and quality management for the three selected mission areas. The four documents are all EMs. The completed DRFs for the documents are in Appendix C. Three of the EM documents were assigned Level 3 recommendations, while the other one was given a Level 0 recommendation. This summary information is in Table 6. The following prioritization order is proposed for the three Level 3 documents:

Table 6. Summary of recommendations on four Engineer Manuals that are cross-cutting relative to water quantity and quality management for the three selected mission areas.

Document	Title	Recommendation
EM 1110-2-1201	Reservoir Water Quality Analysis, 30 June 1987	Level 3
EM 1110-2-3600	Management of Water Control Systems, 30 November 1987	Level 3
EM 1110-2-4000	<i>Sedimentation Investigations of Rivers and Reservoirs</i> , 15 December 1989, Change Number 1, 31 October 1995	Level 3
EM 200-1-3	Requirements for the Preparation of Sampling and Analysis Plans, 1 February 2001	Level 0

- EM 1110-2-1201: *Reservoir Water Quality Analysis*, 30 June 1987. A new EM, or an EP or ETL that would support EM 1110-2-1201, should be prepared. This document should focus on monitoring the influences of ICs on reservoir water quality. Such monitoring should relate to both sedimentation investigations (EM 1110-2-4000) and the management of water control systems (EM 1110-2-3600). Work on a new EM, or an EP or ETL, could be begun in the intermediate term (3–6 months).
- EM 1110-2-4000: *Sedimentation Investigations of Rivers and Reservoirs*, Change Number 1, 31 October 1995. This EM focuses on sediment yield as a function of watershed land uses and on the resultant sedimentation that can occur in rivers or reservoirs associated with flood damage reduction or navigation projects. A new EM focused on monitoring the influences of ICs on sediment yield and resultant sedimentation is needed. An option would involve the preparation of a similarly focused EP or ETL that could supplement EM 1110-2-4000. The included information in either option would support EM 1110-2-1201 (reservoir water quality analysis) and EM 1110-2-3600 (management of water control systems). Work on a new EM, or an EP or ETL, could be initiated in the intermediate term (3–6 months).
- EM 1110-2-3600: *Management of Water Control Systems*, 30 November 1987. This EM addresses many scientific and scheduling issues associated with both data collection and specific decisions related to water releases to meet water control objectives. Information from new documentation related to both EM 1110-2-1201 and EM 1110-2-4000 would provide useful input to either a new EM 1110-2-3600 or a supporting EP or ETL. The new documentation should emphasize monitoring the effects of ICs that could, in turn, influence management decisions for water control systems. Because of the composite nature of EM 1110-2-3600, work on a new EM, or an EP or ETL, should follow the work on the Level 3 recommendations for EM 1110-2-1201 and EM 1110-2-4000. Accordingly, work on EM 1110-2-3600 could be begun in the 9- to 12 month period.

Table 7. Summary of recommendations on seven regulations that are cross-cutting relative to responses to incremental changes.

Document	Title	Recommendation
ER 1165-2-119	<i>Modifications to Completed Projects</i> , 20 September 1982	Level 1
ER 1110-2-100	<i>Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures</i> , 15 February 1995	Level 1
ER 1110-2-240	<i>Water Quality Management</i> , 8 October 1982; Change 1, 30 April 1987; and Change 2, 1 March 1994	Level 1
ER 1110-2-401	<i>Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors</i> , 30 September 1994	Level 0 (Note 1)
ER 1105-2-8154	<i>Water Quality and Environmental Management for Corps Civil Works Projects</i> , 31 May 1995	Level 2
ER 1105-2-100	<i>Continuing Authorities Program</i> , Appendix F, Amendment No. 2, 31 January 2007	Level 0 (See note)
ER 1165-2-208	<i>In-Kind Contribution Provisions of Section 221</i> , 6 June 2008	Level 0
Note: Further work on this IC Project should be completed prior to the final determination of a recommendation level; at this time, a Level 0 recommendation is appropriate.		

6.3 Regulations related to responses to incremental changes

Table 7 summarizes the recommendations for seven documents that are related to responses to ICs that are influencing existing USACE projects in any mission area. The seven documents are all ERs, and their completed DRFs are in Appendix D. One of the seven documents was assigned a Level 2 recommendation, three were given Level 1, and the remaining three were given Level 0 recommendations. Only the Level 2 recommendation and the three Level 1 recommendations were considered in the prioritization order as follows:

- ER 1165-2-119: *Modification to Completed Projects*, 20 September 1982. This ER addresses planning and authorization requirements for modifications to existing projects. Such modifications could result from numerous types of ICs. Examples include policy changes, variability in societal desires, and watershed land use alterations and associated changes in water supplies. The Level 1 recommendation could begin with the preparation of an EP or ETL that would clarify and describe ICs and their relationship to this ER. Alternately, ER 1165-2-119 could be modified to include information on ICs. Work on a modification, or a new EP or ETL, could be initiated in the near term (within 3 months). The Adaptive Management PDT has also targeted ER 1165-2-119 for potential modification. In addition, two memoranda on policy and pro-

- cedural guidance related to ER 1165-2-119 have been issued (USACE, 23 October 2006, and 17 November 2008).
- ER 1110-2-100: *Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures*, 15 February 1995. This ER is related to data gathering and evaluation for existing structures, with the results being used in decision making related to needed modifications in completed projects (ER 1165-2-119). The subject of ICs should be introduced in a modified version of ER 1110-2-100 or in supporting documentation via the issuance of an EP or ETL. This Level 1 recommendation should be coordinated with the above Level 1 recommendation for ER 1165-2-119. However, actual work on a modification, or a new EP or ETL, could be delayed until the intermediate term (3–6 months).
 - ER 1105-2-8154: *Water Quality and Environmental Management for Civil Works Projects*, 31 May 1995. This ER addresses both policies and practices as they relate to water quality management in the vicinity of Civil Works projects. Various reporting requirements are summarized, including annual monitoring reports and three special reports related to factors affecting water quality, unique events such as spills, and specific issues of concern. ICs should be incorporated, as appropriate, in these reports. A Level 2 recommendation was made for ER 1110-2-8154; that is, it should be reorganized or a corollary EC or EP should be developed to specifically address how ICs should be incorporated in the above types of reports. Since this ER discusses changes to USACE projects, it should also be revised to specifically reference other ERs relevant to implementing such changes (e.g., cost sharing requirements, etc.). Work on a reorganized ER, or a new EC or EP, could be initiated in the intermediate term (3–6 months).
 - ER 1110-2-240: *Water Quality Management*, Change 2, 1 March 1994. This ER is focused on the establishment of water control plans for USACE and non-USACE projects. As such, it is related to the above-noted EM 1110-2-3600 (*Management of Water Control Systems*). Accordingly, work on the Level 1 recommendation for this ER could coincide with the above time period suggested for EM 1110-2-3600 (9–12 months). Relative to ER 1110-2-240, it might be desirable to begin with an EP or ETL that could support the inclusion of ICs in the existing ER.

6.4 Key observations related to cross-cutting documents

A total of 21 documents related to three cross-cutting issues were reviewed. The issues included applicability to the three selected mission areas, relevance to water quantity and quality management for the three areas, and responses to incremental changes for existing projects. As a re-

sult of this systematic review, three documents related to water quantity and quality management received Level 3 recommendations, as did one document in the general applicability category. The former include EM 1110-2-1201 (*Reservoir Water Quality Analysis*), EM 1110-2-4000 (*Sedimentation Investigations of Rivers and Reservoirs*), and EM 1110-2-3600 (*Management of Water Control Systems*). The latter is ER 1105-2-100 (*Planning Guidance Notebook*). One document was assigned a Level 2 recommendation; this was ER 1105-2-8154 (*Water Quality and Environmental Management for Corps Civil Works Projects*). Seven documents received Level 1 recommendations: ER 1110-2-1150 (*Engineering and Design for Civil Works Projects*), ER 200-2-2 (*Procedures for Implementing NEPA*), ER 1130-2-540 (*Environmental Stewardship Operations and Maintenance Guidance and Procedures*), EC 1110-2-6065 (*Guidance for a Comprehensive Evaluation of Vertical Datums...*), ER 1165-2-119 (*Modifications to Completed Projects*), ER 1110-2-100 (*Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures*), and ER 1110-2-240 (*Water Quality Management*).

Based on consideration of the centrality of the documents, their individual relationships to other documents, and their overall influence on project planning, the above 12 documents* were prioritized in relation to when work should begin (the shorter period for work initiation coincides with higher priority):

- Near-term initiation of revision work (within 3 months from the decision point): ER 1110-2-1150 and ER 1165-2-119.
- Intermediate-term initiation of revision work (3–6 months): EC 1110-2-6065, EM 1110-2-1201, EM 1110-2-4000, ER 1110-2-100, and ER 1105-2-8154.
- First half of longer-term initiation of revision work (6–9 months): none.
- Second half of longer-term initiation of revision work (9–12 months): ER 1130-2-540, EM 1110-2-3600, and ER 1110-2-240.
- Longer time period for initiation of revision work (more than 12 months): ER 200-2-2 and ER 1105-2-100.

* These documents are listed in Table 13 (p 79 of this report).

7 Review of Inland Navigation Documents and the Resultant Findings

This section addresses the review of 14 documents related to the inland navigation mission of the USACE. The documents were divided into two groups; seven were associated with ERs or EPs, and seven were EMs. The process for document selection and review is described in Section 4.3. The first two subsections are focused on the review findings for the two groups, while the final subsection highlights several key observations.

7.1 Regulations and other documents related to inland navigation

Table 8 summarizes recommendations for seven documents related to inland navigation; the documents include five ERs and two EPs. The completed DRFs for six of the seven documents are in Appendix F; because of its overarching contents, the DRF for EP 1165-2-1 is included in Appendix A. One of the documents was assigned a Level 1 recommendation, one was assigned a Level 4 recommendation, and the remaining five did not need any changes (Level 0 recommendation). The following is proposed for the one Level 1 document:

- ER 1110-2-1457: *Engineering and Design – Hydraulic Design of Small Boat Navigation Projects*, 24 June 1985. This regulation prescribes the design procedure and rationale for development of small boat navigation projects. This ER already implies a number of ICs in relation to causative factors associated with design uncertainties. The Level 1 recommendation should probably focus on the preparation of an ETL as a supporting document. This work could be initiated in the second half of the longer term (9–12 months).

The following is proposed for the one Level 4 document:

- EP 1165-2-1: *Digest of Water Resources Policies and Authorities*, 30 July 1999. This EP provides a brief summary of the existing administrative and legislative water resources policies and authorities pertinent to the Civil Works activities of the USACE. This EP is currently undergoing revision; however, possible changes to the EP are not reflected in the current review. Because this EP provides important documentation of historical changes, amendments, modifications, clarifications, etc., on virtually every aspect of USACE missions, the revised EP should specifically discuss such changes as being incremental. The

scheduled date for issuance of the revised EP is not known. The PDT has reviewed a summary of changes being considered in the preliminary EP revision; however, they are not addressed here.

7.2 Engineer manuals related to inland navigation

Table 9 summarizes the recommendations on seven EMs related to inland navigation. The completed DRFs for the seven EMs are in Appendix G. One of the seven was assigned a Level 1 recommendation, two were assigned a Level 3 recommendation, two were assigned a Level 4 recommendation, and the remaining two were assigned a Level 0 recommendation. No further discussion of the two Level 0 recommended EMs (for EM 1110-2-1604 and EM 1110-2-5027) will be included here.

Table 8. Summary of recommendations on seven regulations and related documents that address inland navigation projects.

Document	Title	Recommendation
EP 1130-2-520	<i>Navigation and Dredging Operations and Maintenance Guidance and Procedures</i> , 29 November 1996	Level 0
EP 1165-2-1	<i>Digest of Water Resources Policies and Authorities</i> , 30 July 1999	Level 4 (See Note)
ER 1110-2-1457	<i>Engineering and Design – Hydraulic Design of Small Boat Navigation Projects</i> , 24 June 1985	Level 1
ER 1110-2-1458	<i>Hydraulic Design of Shallow Draft Navigation Project</i> , 30 April 1998	Level 0
ER 1130-2-520	<i>Navigation and Dredging Operations and Maintenance Policies</i> , 29 November 1996	Level 0
ER 1165-2-27	<i>Establishment of Wetland Areas in Connection with Dredging</i> , 18 August 1989	Level 0
ER 1165-2-122	<i>Studies of Harbor or Inland Harbor Projects by Non-Federal Interests</i> , 26 August 1991	Level 0
Note: EP 1165-2-1 as cited here is dated 30 July 1999. This document is undergoing revision and is expected to be superseded at some point in the future. The PDT is aware of the revisions under current consideration for this EP.		

Table 9. Summary of recommendations on seven engineer manuals for inland navigation projects.

Document	Title	Recommendation
EM 1110-2-1604	<i>Hydraulic Design of Navigation Locks</i> , 1 May 2006	Level 0
EM 1110-2-1605	<i>Hydraulic Design of Navigation Dams</i> , 12 May 1987	Level 1
EM 1110-2-2602	<i>Planning and Design of Navigation Locks</i> , 30 September 1995	Level 4
EM 1110-2-2607	<i>Planning and Design of Navigation Dams</i> , 31 July 1995	Level 4
EM 1110-2-5025	<i>Dredging and Dredged Material Disposal</i> , 25 March 1983	Level 3
EM 1110-2-5026	<i>Beneficial Uses of Dredged Material</i> , 30 June 1987	Level 3
EM 1110-2-5027	<i>Confined Disposal of Dredged Material</i> , 30 September 1987	Level 0

The following prioritization order is for the two Level 4 documents:

- EM 1110-2-2602: *Planning and Design of Navigation Locks*, 30 September 1995. This manual was issued as guidance for engineers and design offices within the Corps engaged in the planning, engineering layout, analysis, and design of navigation locks for Civil Works navigation projects on inland waterways. This EM provides a compilation of detailed considerations and requirements to be incorporated into planning studies for navigation projects. As such, the manual requires periodic updating as new information or additional considerations affecting planning studies and recommendations are known. Appendix D in this EM is especially important as it provides recommendations based on lessons learned from an actual major incident involving navigation projects. The Level 4 recommendation is to establish a work group to study and develop recommended solutions to identified problems beyond the scope of the ICP. In the course of this work group's efforts, the manual should be updated. The term IC should be defined, and the important relationship of ICs to factors affecting modern navigation planning studies and recommendations should be discussed. Specifically, Appendix D should be revised as needed to continue developing and applying lessons learned from major incidents to future navigation planning considerations. For example, the loss of pool at Belleville L&D, as well as the incident at Montgomery L&D, should be incorporated. Also, the failure of the gate at Markland's main lock chamber in September 2009 should be addressed. It is further recommended that work on preparing the new EM should be initiated in the 3- to 6-month time frame (the intermediate term).
- EM 1110-2-2607: *Planning and Design of Navigation Dams*, 31 July 1995. This manual was issued as guidance for individuals and work groups within the Corps engaged in the structural planning, layout, and design of navigation dams for Civil Works projects. The structural design of gates is not covered in this manual. This EM compiles detailed considerations and requirements to be incorporated into planning studies for navigation dams. As such, the manual requires periodic updating as new information or additional considerations affecting planning studies and recommendations are known. Appendix C in this EM is especially important as it provides recommendations based on lessons learned from an actual major incident involving navigation projects. The Level 4 recommendation is to establish a work group to study and develop recommended solutions to identified problems beyond the scope of the ICP. In the course of this work group's efforts, the manual

should be updated. The term IC should be defined, and the important relationship of ICs to factors affecting modern navigation planning studies and recommendations should be discussed. Specifically, Appendix C should be revised to continue developing and applying lessons learned from major incidents to future navigation planning considerations. For example, the loss of pool at Belleville L&D, as well as the incident at Montgomery L&D, should be incorporated. It is further recommended that work on preparing the new EM could be initiated in the intermediate term (the 3- to 6-month time frame).

The following prioritization order is for the two Level 3 documents:

- EM 1110-2-5025: *Dredging and Dredged Material Disposal*, 25 March 1983. This manual provides an inventory of the dredging equipment and disposal techniques used in the U.S. and provides guidance for activities associated with new work and maintenance projects. This manual further provides guidance on the evaluation and selection of equipment and evaluation of disposal alternatives. The EM is old, and more recently developed and tested methods, especially for beneficial uses of dredged material, should be included in an update. The Level 3 recommendation is to prepare a new document specifically focused on ICs or issue an EC incorporating recent information on dredging and disposal methods. It is also recommended that work on preparing the new EM could be initiated in the 3- to 6-month time frame (the intermediate term).
- EM 1110-2-5026: *Beneficial Uses of Dredged Material*, 30 June 1987. This manual provides guidance for planning, designing, developing, and managing dredged material for beneficial uses and incorporating ecological concepts and engineering designs with biological, economical, and social feasibility. The EM is old, and more recently developed and tested methods should be included in an update. The Level 3 recommendation is to prepare a new document specifically focused on ICs or issue an EC incorporating recent information on dredging and disposal methods to achieve beneficial uses. It is also recommended that work on preparation of the new EM could be initiated in the 3- to 6-month time frame (intermediate term).

The following is proposed for the one Level 1 document:

- EM 1110-2-1605: *Hydraulic Design of Navigation Dams*, 12 May 1987. This EM provides current guidance and engineering procedures for the hydraulic design of navigation dams. Incremental changes should be

defined and the important relationships to factors affecting modern navigation dam designs should be discussed. Specifically, Section 3 should be revised to consider the projected effects of reasonably foreseeable future changes in the watershed on hydrological considerations discussed in the section. The Level 1 recommendation for EM 1110-2-1605 could be accomplished by modifying the EM itself or by preparing a supporting ETL or EP. It is recommended that the Level 1 work on EM 1105-2-1605 be initiated in the next 9–12 months (the second half of the longer-term period).

7.3 Key observations related to inland navigation documents

Navigation is the oldest Civil Works mission of the USACE. Authority for inland navigation is derived from the “Commerce Clause” of the Constitution and was confirmed by a decision of the U.S. Supreme Court in 1824. Throughout the history of the USACE’s inland navigation mission, a wide variety of ICs have occurred. Incremental changes are typically from three primary sources: (1) addition or modification of authorities brought about through legislative action, (2) technological advances, and (3) changing needs for waterway transportation of goods.

A review of USACE documents conducted thus far provides a snapshot of current requirements and, to some extent, a historical perspective of changes that have occurred through time. Documents reported here include ERs, EPs, ECs, EMs, and ETLs. These reviews constitute the initial step in examining ICs related to inland navigation. As the ICP progresses, reviews of other documents from a variety of sources are also scheduled.

Of the 14 documents related specifically to inland navigation, seven were found to require no further clarification or revision to incorporate consideration of ICs. The remaining seven documents are recommended for some level of amendment to incorporate the subject of incremental change. One ER (ER 1110-2-1457) and one EM (EM 1110-2-1605) were recommended for the lowest level of change (Level 1). Recommendations for these were to either introduce ICs and add them, as appropriate, throughout the document, or issue an ETL or EP clarifying and explaining ICs in relation to the document. These revisions could be initiated in the 9- to 12-month time frame (the second half of the longer-term period).

None of the documents were assigned a Level 2 recommendation (the document should be reorganized so that ICs become a central feature, or a

corollary EC or EP could be produced that addresses the dynamic influence of ICs on the topic covered in this document).

Two of the documents (EM 1110-2-5025 and EM 1110-2-5026) received a Level 3 recommendation (prepare a new document that specifically focuses on ICs or issue an EC or revised EM). In both cases, the EMs needed to be updated to incorporate changes in dredging technologies, especially those focused on beneficial uses of dredged materials. These revisions could be initiated in the intermediate term (the 3- to 6-month time frame).

Three documents (EP-1165-2-1, EM 1110-2-2602, and EM 1110-2-2607) received a Level 4 recommendation, (establish a work group to study the concerns and develop recommended solutions to identified problems beyond the scope of the ICP). EP 1165-2-1 is currently undergoing revision and is expected to be superseded. Therefore, no time frame for initiation of revision was denoted. The two EMs should be revised as needed to continue developing and applying lessons learned from major incidents to future navigation planning considerations. For example, the loss of pool at Belleville L&D, as well as the incident at Montgomery L&D, should be incorporated. Also, the failure of the gate at Markland's main lock chamber in September 2009 should be included. It is recommended that work on preparation of the new EMs be initiated in the 3- to 6-month time frame (the intermediate term).

This priority-related summary information is included in Table 13 (p 76).

8 Review of Flood Damage Reduction Documents and Resultant Findings

This section addresses the review of 24 documents related to flood damage reduction studies. The documents were divided into two groups: 16 were associated with ERs, EPs, or ETLs; and 8 were EMs. The process for document selections and reviews is described in Section 4.3. The first two subsections are focused on the review findings for the two groups, while the final subsection highlights several key observations.

8.1 Regulations and other documents related to flood damage reduction studies

Table 10 summarizes recommendations on 16 documents related to flood damage reduction studies; the documents include 11 ERs, four EPs, and one ETL. The completed DRFs for the 16 documents are in Appendix I. Nine of the documents were assigned a Level 1 recommendation, and the remaining seven did not need any changes (Level 0 recommendation). The following prioritization order is proposed for the nine Level 1 documents:

- ER 1165-2-21: *Flood Damage Reduction Measures in Urban Areas*, 30 October 1980. This ER includes policies and decision criteria related to USACE participation in urban flood damage reduction projects. Early consideration of ICs would potentially improve decision-making for such urban projects. (Such considerations would be relatively easy to introduce.) Also, it would be easier to prepare an EP or ETL supporting this ER to modify the ER itself. Work on such an EP or ETL could be initiated in the near term (within 3 months).
- ER 1105-2-101: *Risk Analysis for Flood Damage Reduction Studies*, 3 January 2006. This relatively recent ER describes an important tool that should be increasingly used in planning and designing flood damage reduction projects. This ER already implies a number of ICs in relation to causative factors associated with design uncertainties. Because this ER is relatively recent, the Level 1 recommendation should probably focus on the preparation of an EP or ETL as a supporting document. Further, because of the importance of addressing ICs within this subject area, this work could be initiated in the near term (within 3 months). Work related to ER 1105-2-101 would need to be done in collaboration with others involved in its development and with other PDTs related to the Campaign Plan.

Table 10. Summary of recommendations on sixteen regulations and related documents that address flood damage reduction projects.

Document	Title	Recommendation
EP 870-1-29	<i>The Evolution of the 1936 Flood Control Act</i> , 1988	Level 0
EP 1110-2-7	<i>Hydrologic Risk</i> , May 1988	Level 0
ER 1110-2-1405	<i>Hydraulic Design for Local Flood Protection Projects</i> , 30 September 1982	Level 1
ER 1110-2-1464	<i>Hydrological Analysis of Watershed Runoff</i> , 30 June 1994	Level 1
ER 1110-8-2(FR)	<i>Inflow Design Floods for Dams and Reservoirs</i> , 1 March 1991	Level 1
ER 1110-2-50	<i>Low Level Discharge Facilities for Drawdown of Impoundments</i> , 22 August 1975	Level 0
ER 1165-2-21	<i>Flood Damage Reduction Measures in Urban Areas</i> , 30 October 1980	Level 1
ER 1130-2-530	<i>Flood Control Operations and Maintenance Policies</i> , 30 October 1996	Level 1
ER 1105-2-101	<i>Risk Analysis for Flood Damage Reduction Studies</i> , 3 January 2006	Level 1
ER 1165-2-121	<i>Flood Control Cost-Sharing Requirements Under the Ability-to-Pay Provision</i> , Section 103(M) of PL99-662, 1 November 1989	Level 0
ER 1130-2-406	<i>Shoreline Management at Civil Works Projects</i> , 31 October 1990 to 28 May 1999	Level 0
ER 1130-2-550	<i>Recreation Operations and Maintenance Policies</i> , 15 November 1996 (Changes on 1 October 1999; 1 March 2002; 15 August 2002; 30 August 2008; and 30 March 2009)	Level 1
EP 1130-2-550	<i>Recreation Operations and Maintenance Guidance and Procedures</i> , 15 November 1996 (Changes on 1 October 1999; 1 March 2002; 15 August 2002; and 30 August 2008)	Level 1
ER 1165-2-26	<i>Implementation of Executive Order 11988 on Flood Plain Management</i> , 30 March 1984	Level 1
ETL 1110-2-569	<i>Design Guidance for Levee Underseepage</i> , 1 May 2005	Level 0
EP 1165-2-314	<i>Flood Proofing</i> , 15 December 1995	Level 0

- **ER 1165-2-26: *Implementation of Executive Order 11988 on Flood Plain Management*, 30 March 1984.** Some proposed changes to EO 11988 are currently under consideration. If such changes are promulgated, ER 1165-2-26 will probably need to be modified or a supporting EP or ETL issued to provide basic supporting information. An important topic in the supporting information should be related to the importance of ICs in developing and implementing flood plain management programs. Depending on the timing of proposed changes, such an EP or ETL could be initiated in either the near term (within three months) or the intermediate term (3–6 months).
- **ER 1110-2-1464: *Hydrological Analysis of Watershed Runoff*, 30 June 1994.** This ER addresses the scope of watershed-runoff studies, includ-

- ing the reporting of results. ICs could be primary contributors to changes in runoff in local to regional watersheds, so the introduction of such supporting information is important. The Level 1 recommendation for this ER could be accomplished via the preparation of an ETL or EP. Work on the ETL or EP could be initiated in the intermediate term (3–6 months).
- ER 1130-2-530: *Flood Control Operations and Maintenance Policies*, 30 October 1996. This ER addresses the operation and maintenance of USACE flood damage reduction projects and USACE-built projects operated and maintained by local sponsors. ICs could be used to denote causative factors prompting the need for inspections and evaluations. The Level 1 recommendation could be accomplished via the preparation of an EP or ETL containing supporting information. Work could be initiated in the longer term (6–12 months).
 - ER 1110-2-1405: *Hydraulic Design for Local Flood Protection Projects*, 30 September 1982. This ER addresses the procedure and rationale for the hydraulic design of local flood damage reduction projects. Since ICs can influence both current and future designs for new projects, as well as modifications in existing ones, a Level 1 recommendation was made for this ER. This recommendation could be accomplished via the preparation of an EP or ETL with supporting information and examples. Work could be initiated in the longer term (6–12 months).
 - ER 1110-8-2 (FR): *Inflow Design Floods for Dams and Reservoirs*, 1 March 1991. This ER delineates hydrologic engineering requirements for selecting and accommodating inflow design floods (IDFs) for dams and reservoirs. Historical IC information could be used in developing current IDFs, and future ICs could be used for projecting future IDFs. Accordingly, a Level 1 recommendation was made for ER 1110-8-2 (FR). This recommendation could be satisfied by modifying the ER or by issuing an ETL containing information on ICs. The latter approach is preferable. Work could be initiated on this ETL in the longer term (6–12 months). Collaboration with USACE hydraulics and hydrology specialists would be desirable in this work effort.
 - ER 1130-2-550: *Recreation Operations and Maintenance Policies*, 30 March 2009. This ER establishes policies for management of recreation programs and operation and maintenance of USACE recreation facilities at water resources projects. Attention should be given to ICs that can influence such programs and activities. A Level 1 recommendation was made, with the options ranging from modifying the ER, to modifying its supporting document (EP 1130-2-550), to the preparation of a new supporting EP or ETL. The preparation of a new

EP or ETL may be the more efficient option from a time and cost basis. Work could be initiated in the longer term (6–12 months). Collaboration with USACE recreation specialists would be desirable.

- EP 1130-2-550: *Recreation Operations and Maintenance Guidance and Procedures*, 30 August 2008. This EP contains supplemental information related to ER 1130-2-550. Again, a Level 1 recommendation was made, with the options being to modify this EP or prepare a new ETL that addresses ICs and their relationship to recreational programs and practices. The preparation of a new ETL may be the most efficient. Again, work could begin in the longer term (6–12 months), and it should be coordinated with the work on ER 1130-2-550. Collaboration with USACE recreation specialists would also be desirable.

8.2 Engineer manuals related to flood damage reduction studies

Table 11 summarizes the recommendations on eight EMs related to such studies. The completed DRFs for the eight EMs are in Appendix J. Six of the eight were assigned a Level 1 recommendation, with the two remaining ones assigned a Level 0 recommendation. No further discussion of the two Level 0 recommendation EMs (for EM 1110-2-1411 and EM 1110-2-1913) will be included here. The following prioritization order is proposed for the six Level 1 documents. Each of the six included a note reflecting that further work on this IC Project should be completed prior to the final determination of a recommendation level. This note is reflected in the recommended initiation times for work on each of the six documents:

- EM 1110-2-1619: *Risk-Based Analysis for Flood Damage Reduction Studies*, 1 August 1996. This EM, which is related to ER 1105-2-101 (*Risk Analysis for Flood Damage Reduction Studies*), addresses procedures for analyzing risk and uncertainty. Further, ICs can influence risk and uncertainty associated with flood damage reduction studies. The Level 1 recommendation for EM 1110-2-1619 could be accomplished by modifying the EM itself or by preparing a supporting ETL or EP. A time schedule for initiating Level 1 work on ER 1105-2-101 was proposed above as being within three months. Work on the Level 1 recommendation for the analysis focus of EM 1110-2-1619 could be initiated in either the intermediate term (3–6 months) or the first part of the longer term (6–9 months).

Table 11. Summary of recommendations on eight engineer manuals for flood damage reduction projects.

Document	Title	Recommendation
EM 1110-2-1205	<i>Environmental Engineering for Flood Control Channels</i> , 15 November 1989	Level 1 (See Note)
EM 1110-2-1411	<i>Standard Project Flood Determination</i> , 1 March 1965	Level 0
EM 1110-2-1417	<i>Flood-Runoff Analysis</i> , 31 August 1994	Level 1 (See Note)
EM 1110-2-1418	<i>Channel Stability Assessment for Flood Control Projects</i> , 31 October 1994	Level 1 (See Note)
EM 1110-2-1419	<i>Hydrologic Engineering Requirements for Flood Damage Reduction Studies</i> , 31 January 1995	Level 1 (See Note)
EM 1110-2-1420	<i>Hydrologic Engineering Requirements for Reservoirs</i> , 31 October 1997	Level 1 (See Note)
EM 1110-2-1619	<i>Risk-Based Analysis for Flood Damage Reduction Studies</i> , 1 August 1996	Level 1 (See Note)
EM 1110-2-1913	<i>Design and Construction of Levees</i> , 30 April 2000	Level 0
Note: Further work on this IC Project should be completed prior to the final determination of a recommendation level; at this time, a Level 1 recommendation is appropriate.		

- **EM 1110-2-1419: *Hydrologic Engineering Requirements for Flood Damage Reduction Studies*, 31 January 1995.** This EM integrates hydrologic engineering requirements with the National Economic Development objective. ICs can influence the selection, design, and operational features of various flood damage reduction measures. Given the content of EM 1110-2-1419, the Level 1 recommendation could be more appropriately addressed via the preparation of an ETL or EP. Work on an ETL or EP could be initiated in the longer term (6–12 months).
- **EM 1110-2-1420: *Hydrologic Engineering Requirements for Reservoirs*, 31 October 1997.** The EM addresses hydrologic engineering investigations associated with the planning and design of reservoir projects. ICs can influence both the design and operation of different types of reservoirs and their appurtenances. Further work on this IC project will focus in part on ICs and their influence, as well as their incorporation in the design process. It appears that the preparation of a supporting ETL or EP could be used in lieu of modifying EM 1110-2-1420. Work on such an ETL or EP could be initiated in the longer term (6–12 months).
- **EM 1110-2-1417: *Flood-Runoff Analysis*, 31 August 1994.** This EM describes several methods for evaluating the flood-runoff characteristics of watersheds. Since ICs can influence such characteristics, the EM needs to be updated with IC-related information that could be used in project design and operation. The preparation of a supporting ETL or EP could be used to fulfill the Level 1 recommendation. Work on such a

- document could be initiated in the latter part of the longer term (9–12 months).
- EM 1110-2-1418: *Channel Stability Assessment for Flood Control Projects*, 31 October 1994. This EM highlights potential channel instability and sedimentation effects associated with flood damage reduction projects. ICs can influence channel stability characteristics, so they should be more thoroughly identified and addressed in EM 1110-2-1418. An option to modifying this EM would be to prepare a supporting ETL or EP that highlights ICs and their channel stability influences. Work on such a supporting document could be initiated in the latter part of the longer term (9–12 months). This work could be coordinated with work on EM 1110-2-1417 and vice versa.
 - EM 1110-2-1205: *Environmental Engineering for Flood Control Channels*, 15 November 1989. This EM addresses the planning, engineering, design, and construction of flood control channels, levees, and associated structures. ICs could be important in that they can change runoff flows and timing, thus influencing the need for flood control projects. Specific details related to ICs can also influence project design and evaluation. The findings contained in ETLs or EPs developed for EM 1110-2-1417 and EM 1110-2-1418 could have relevance to this EM. An option to modifying EM 1110-2-1205 would be to prepare a specific ETL or EP with supporting information. Work on such a supporting document could be initiated in the latter part of the longer term (9–12 months). This work could be coordinated with work on EM 1110-2-1417 and EM 1110-2-1418.

8.3 Key observations related to flood damage reduction documents

A total of 15 documents received a Level 1 recommendation, including eight ERs, six EMs, and one EP. Following the consideration of the centrality of the documents, their individual relationships to other documents, and their overall influence on project planning, the 15 documents were prioritized in relation to when work should begin (the shorter period for work initiation coincides with higher priority):

- Near-term initiation of revision work (within 3 months from the decision point): ER 1165-2-21, ER 1105-2-101, ER 1165-2-26, and EM 1110-2-1619 (could be extended to 6- to 9-month period).
- Intermediate-term initiation of revision work (3–6 months): ER 1110-2-1464.
- First half of longer-term initiation of revision work (6–9 months): none”

- Longer-term initiation of revision work (6–12 months): ER 1110-2-1405, ER 1110-8-2(FR), ER 1130-2-530, ER 1130-2-550, EP 1130-2-550, EM 1110-2-1419, and EM 1110-2-1420.
- Second half of longer-term initiation of revision work (9–12 months): EM 1110-2-1205, EM 1110-2-1417, and EM 1110-2-1418.

This summary information is included in Table 13 (p 76).

9 Review of Ecosystem Restoration Documents and the Resultant Findings

Recent decades have seen an evolution in ecosystem restoration, protection, and sustainable use initiatives at all levels of government and within the stakeholder community. The ecosystem-based approach to restoration, protection, and sustainable use requires collaboration at all levels of government, interagency cooperation, and application of multiple authorities. The USACE has historically played a prominent role in restoration at various geographic scales, drawing on a number of legislative authorities.

Ecosystem restoration, which is now one of the primary missions of the USACE Civil Works program, is defined as achieving a “return of natural areas or ecosystems to a close approximation of their conditions prior to disturbance, or to less degraded, more natural conditions” (USACE 1999b). In offering this definition, the USACE recognizes that, in some circumstances, a return to pre-disturbance conditions may not be feasible. In those instances, the goal is to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system. Ecosystem restoration efforts will involve comprehensive examination of the problems contributing to the system degradation and the development of alternative means for their solution.

9.1 Incremental changes in ecosystem restoration programs and policies based on a review of Water Resources Development Acts – 1976 to 2007

The Water Resources Development Acts (WRDAs) authorize the Secretary of the Army to study and/or implement various projects and programs for improvements to rivers and harbors of the U.S. and for other purposes. It is also the legislative vehicle for implementing policy changes with respect to the USACE’s water resource projects and programs. A number of WRDAs contain general environmental provisions pertinent to Civil Works water resources development program or to the management of environmental resources. This sub-section summarizes these provisions, as well as statements about the implementation guidance where available.

9.1.1 WRDA 1976 (PL 94-587)

This Act authorized additional water projects for development by the USACE, modified certain features of previously authorized projects, and included specific conservation measures for some of the projects. Section 150 authorized the Chief of Engineers to plan and establish wetland areas as part of an authorized water resources development project under his jurisdiction. The Act identified several conditions in which the Chief may establish wetland areas under his authority, such as environmental, economic, and social benefits of the wetland area that justify the increased cost, above the cost for alternative methods of disposing dredged material for such water resources projects. This provision does not include any non-Federal cost sharing as was subsequently established in 1986.

9.1.2 WRDA 1986 (PL 99-662)

This Act authorized for construction and/or study 270 USACE projects (port development, inland navigation, flood control, streambank erosion, and shoreline erosion, as well as feasibility and reconnaissance studies). It also de-authorized 290 projects and provided for de-authorization of other projects if funds had not been obligated for construction, including planning and design, within five years of this statute's enactment. A Section 704(b) study of the USACE's capability to conserve fish and wildlife authorized the Secretary of the Army to conduct projects involving alternative or beneficially modified habitats for fish and wildlife, including but not limited to manmade reefs for fish. The scope of the study includes the use of engineering or construction capabilities to create alternative habitats or to improve, enlarge, develop, or otherwise beneficially modify existing habitats of fish and wildlife. A non-Federal cost share of 25 percent was required. A limit was not placed on Federal expenditures per project; however, a \$5 million limit on total Federal expenditures for the program was established.

Section 904 of WRDA 1986 identified issues that are required for the Corps to address, include protecting and restoring the quality of the total environment and preservation of historical and cultural values. Section 906 provided general authority to undertake mitigation measures for projects, whether completed, underway, or unstarted, including the acquisition of any needed related lands. All projects submitted by the Corps in the future must include either specific mitigation plans or determinations that such projects will have negligible impacts on fish and wildlife [Section

906(d)]. Mitigation costs are to be allocated to the project purposes and cost shared accordingly.

Section 1135(a) authorized the review of existing water resources projects to determine the need for modifications in the structures and operations of projects constructed prior to the authorization of the Act for the purpose of improving the quality of the environment in the public interest. In addition, Section 1135(b) initially authorized a two-year demonstration program for the purposes of making such modifications, in the structures and operations of water resources projects, where feasible and consistent with the authorized project purposes and where they will improve the environment. A non-Federal cost share of 25 percent was specified.

9.1.3 WRDA 1988 (PL 100-676)

Section 41(a) amended Section 1135(b) of WRDA 1986 by striking out the two-year period for a demonstration program and inserting a five-year period. Section 45(a) authorized the Secretary to carry out projects to construct and engage in other activities necessary for the restoration of wetlands of sufficient scale for research and demonstration purposes.

9.1.4 WRDA 1990 (PL 101-640)

Section 304 amended project modifications for improving the environment (Section 1135 of WRDA 1986) from a “demonstration project” to a continuing program. The maximum annual appropriations were established as \$15 million. Section 306 directed the Secretary to include an environmental protection mission as one of the primary missions of the USACE in planning, designing, constructing, operating, and maintaining water resources projects. Further, Section 307 established, as part of the USACE’s water resources development program, an interim goal of no overall net loss of the Nation’s remaining wetland base, as defined by acreage and function, and a long-term goal to increase the quality and quantity of the Nation’s wetlands as defined by acreage and function. Finally, Section 312(b) stated that the Secretary may remove contaminated sediments from the navigable waters of the U.S. for the purpose of environmental enhancement and water quality improvement.

9.1.5 WRDA 1992 (PL 102-580)

Section 202 amended Section 1135 (WRDA 1986) by increasing the annual funding program to \$25 million, with required Congressional approval for

modifications costs estimated to exceed \$5 million per project. Section 203 authorized the Secretary, in carrying out water resources projects for environmental protection and restoration or recreation, to accept contributions of cash funds, materials, and services from persons, including governmental entities, but excluding the project sponsor. Section 204(a) stated that the Secretary is authorized to carry out projects for the protection, restoration, and creation of aquatic and ecologically related habitats, including wetlands, in connection with dredging for construction, operation, or maintenance of an authorized navigation project.

9.1.6 WRDA 1996 (PL 104-303)

Section 107 addressed small projects for improving the environment. More specifically, the Secretary of the Army was authorized to conduct a study for certain projects to determine if funding and implementation is warranted.

Section 204 states that if the Secretary determines that the construction of a water resources project has contributed to the degradation of environmental quality, the Secretary may undertake measures for restoration of environmental quality that are associated with restoration, if such measures do not conflict with the authorized project purposes. Section 206 (a) states that the Secretary may carry out an aquatic ecosystem restoration and protection project if the project will improve the quality of the environment, is in the public interest, and is cost effective. This section also addresses cost limitations and funding for such projects.

Finally, Section 503(a) authorizes the Secretary to provide technical, planning, and design assistance to non-Federal interests for carrying out watershed management, restoration, and development projects.

9.1.7 WRDA 1999 (PL 106-53)

Title II of WRDA 1999 amended the Flood Control Act of 1936 to authorize the use of funds contributed by states and other political subdivisions for environmental restoration work. Until this change, only flood control work could be done with funds from others. Section 516 stated that the Secretary shall examine using, and if appropriate encourage others to use, innovative treatment technologies, including membrane technologies, for watershed and environmental restoration and protection projects involving water quality. This section amends WRDA 1996 by authorizing projects to reduce flood hazards and restore the natural functions and values of rivers

throughout the U.S. It also requires non-Federal interests to pay 35 percent of the cost of any local environmental restoration or nonstructural flood control project. Further, a cost limitation of \$30 million on any single project was imposed.

9.1.8 WRDA 2000 (PL 106-541)

Section 202 authorized the Secretary to assess the water resources needs of river basins and watersheds of the U.S., including needs relating to ecosystem protection and restoration, flood damage reduction, navigation and ports, watershed protection, water supply, and drought preparedness. These assessments are to be carried out in coordination with several other agencies (named in the Act), as appropriate. Additionally, Section 216 described the term “water resources project” to include a project for navigation, flood control, hurricane and storm damage reduction, emergency streambank and shore protection, and ecosystem restoration. Finally, Section 223 directed the Secretary to conduct a monitoring program of the economic and environmental results of up to five eligible ecosystem restoration projects. The monitoring shall be carried out for 12 years, with performance reports every three years.

9.1.9 WRDA 2007 (PL 110-114)

This law was the result of the first Congressional override of a veto by President George W. Bush. WRDA 2007 authorized approximately 900 USACE projects, studies, and modifications to existing authorizations. Section 2039 required the Secretary to ensure that a recommended ecosystem restoration project includes a plan for monitoring the success of the restoration and to consider the cost of carrying out the monitoring as a project cost for a period of 10 years from completion of the project construction. WRDA 2007 also included two specific sections on ecosystem restoration. For example, Section 6007 (Florida Everglades) directs the Secretary to complete the development and testing of the regional engineering model for environmental restoration as expeditiously as practicable. A second example was in Section 7002, which focuses on the Louisiana coastal area and directs the Secretary to develop a comprehensive plan, in coordination with the governor of Louisiana, for protecting, preserving, and restoring the coastal Louisiana ecosystem. Section 7004 established the Coastal Louisiana Ecosystem Protection and Restoration Task Force to make recommendations to the Secretary regarding several components, including policies, plans, programs, financial participation, and a comprehensive plan to be developed.

9.2 Policy guidance letters related to ecosystem restoration

The Congress typically authorizes USACE projects and policy changes in WRDAs. Policy Guidance Letters (PGLs) are often prepared by the USACE to address specific WRDA issues. Five PGLs are briefly highlighted here to illustrate practical implementation considerations and incremental changes:

- Policy Guidance Letter No. 24: *Restoration of Fish and Wildlife Habitat Resources* (7 March 1991). This PGL states that fish and wildlife restoration activities may be recommended only if justified and (1) a Civil Works project has contributed to the degradation or (2) restoration can be most cost effectively accomplished through modification of an existing Civil Works project. Proposals for restoration will generally require 25 percent local cost sharing in the implementation of the restoration and full non-Federal operation and maintenance of the completed project. Projects for fish and wildlife restoration involving modifications in the structures and operations of existing projects may be implemented under the authority of Section 1135(b) of WRDA 1986, as amended. This PGL (No. 24) was rescinded (23 March 1998), with its contents effectively superseded by ecosystem restoration information incorporated in Section 3-5 of the *Planning Guidance Notebook* (ER 1105-2-100) (USACE 2000).
- Policy Guidance Letter No. 48: *Cost Sharing for Specifically Authorized Environmental Projects* (21 July 1997). This PGL sets forth USACE policy regarding cost sharing for construction (implementation) of specifically authorized projects and separable elements for ecosystem (environmental) protection and restoration, and it implements Section 210 of WRDA 1996. The ecosystem restoration projects were generally recommended for 75 percent Federal and 25 percent non-Federal cost sharing except that 50-50 cost sharing was recommended in cases where the ecosystem restoration project involved modifications to an existing Federal project that had adversely impacted other project purposes.
- Draft Policy Guidance Letter No. 60: *Water Quality and Water Resources Development Projects* (5 June 1998). This PGL states the principles and policy of providing water quality improvement as a means of achieving ecosystem restoration and protection. Improvement in water quality can be the means by which degraded streams and other degraded water bodies are restored to a less degraded condition (e.g., acid mine drainage). Providing ecosystem restoration can be a means for improving water quality adjacent to degraded ecosystems, e.g., restora-

- tion of contaminated soils and sediment. Water plays a significant organizing influence on the other attributes of the ecosystem, i.e., soils, plant and animal species, and communities that characterize the ecosystem itself. It is the policy of the Federal government that in the design, construction, management, operation, and maintenance of facilities, it shall provide leadership in the nationwide effort to protect and enhance the quality of water and land resources and to comply with all Federal, state, interstate, and local requirements in the same manner and extent as other entities.
- Policy Guidance Letter No. 59: *Recreation Development at Ecosystem Restoration Projects* (11 June 1998). This policy is applicable to the planning and development of outdoor recreation facilities at single-purpose ecosystem restoration projects and projects constructed under the authority of Section 1135 of WRDA 1986, Section 204 of WRDA 1992, and Section 206 of WRDA 1996. Potential recreation development at Civil Works projects depends on the type of project, the location, and the demographics of the surrounding area. This PGL also states the principles for recreation development at new USACE ecosystem restoration projects. Planning of recreation facilities to be cost shared at new ecosystem restoration projects must comply with three major criteria: (a) inclusion on the project checklist, (b) economic justification, and (c) the ten percent limit rule. This rule states that the level of financial participation in recreation development by USACE may not increase the Federal cost of the ecosystem restoration project by more than 10 percent without prior approval of the Assistant Secretary of the Army (Civil Works). The cost of recreation facility development is shared 50/50 percent between the Federal and non-Federal sponsors.
 - Policy Guidance Letter No. 61: *Application of Watershed Perspective to Corps of Engineers Civil Works Programs and Activities* (27 January 1999). There is a growing recognition that locally perceived water resources problems have regional dimensions. Many activities occurring in a watershed are interrelated so managing water resources has evolved to more of a holistic, collaborative effort. The USACE watershed perspective accommodates multi-objective and multi-purpose planning and the associated investigations. USACE will integrate its watershed perspective into opportunities within and among Civil Works elements. The watershed perspective encourages collaborative efforts that advocate the integration of interests in the watershed by identifying, scoping, and developing comprehensive water resources management goals.

9.3 Regulations and other documents related to ecosystem restoration projects

Table 12 summarizes recommendations on six documents related to ecosystem restoration projects, including four ERs and two EPs. The completed DRFs for the six documents are in Appendix K. Four of the documents were assigned a Level 1 recommendation, and the remaining two did not need any changes (Level 0 recommendation). The following information is related to the four Level 1 documents:

- EP 1165-2-1: *Digest of Water Resources Policies and Authorities* (30 July 1999), Chapter 19 – *Environmental Restoration and Protection*. This EP attempts to clarify linkages among various environmental statutes, programs, and policies established by the WRDAs. This chapter defines the term “ecosystem” as a dynamic and interrelated complex of plant and animal communities, including humans, and their associated non-living environment. It describes an ecosystem approach that consists of restoring and/or protecting structures and function of an ecosystem, or parts thereof, recognizing that all its components are inter-related. This digest is being revised (2009). A Level 1 recommendation is made for Chapter 19 in this EP. The term IC should be defined and added in appropriate places in this EP while it is being revised.
- ER 1165-2-501: *Civil Works Ecosystem Restoration Policy* (30 September 1999). Ecosystem restoration efforts will involve a comprehensive examination of the problems contributing to system degradation and the development of alternative means for their solution. The intent of restoration is to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system. This has been a key regulation for ecosystem restoration since it was recognized as one of the primary missions of the Civil Works program. Level 1 is recommended for this ER; incremental changes should be defined and added within this ER, as appropriate, or an ETL (expanding ICs in relation to the document) can be developed.

Table 12. Summary of recommendations on six regulations and other documents which address ecosystem restoration projects.

Document	Title	Recommendation
EP 1165-2-1	Digest of Water Resources Policies and Authorities, 30 July 1999	Level 1
ER 1165-2-501	Civil Works Ecosystem Restoration Policy, 30 September 1999	Level 1
EP 1165-2-502	Ecosystem Restoration – Supporting Policy Information, 30 September 1999	Level 1
ER 1130-2-540	Environmental Stewardship Operations and Maintenance Policies, 15 November 1996	Level 0
ER 1165-2-27	Establishment of Wetlands Areas in Connection with Dredging, 18 August 1989	Level 1
ER 1165-2-28	Corps of Engineers Participation in Improvements for Environmental Quality, 30 April 1980	Level 0

- EP 1165-2-502: *Ecosystem Restoration – Supporting Policy Information* (30 September 1999). This pamphlet provides policy information in support of ER 1165-2-501. It states that ecosystem restoration needs and opportunities shall be incorporated in Master Plans and Operational Management Plans and included in budget requests, as appropriate. This EP provides greater visibility to this mission area and details the ecosystem restoration philosophy, policy, and approach. Restoration projects should be conceived in a system context, to improve their potential for long-term survival as self-sustaining, functioning systems. No change is recommended to this policy, with the exception that the term IC be defined and added in appropriate places when the EP is updated (Level 1 recommendation).
- ER 1130-2-540: *Environmental Stewardship Operations and Maintenance Policies* (15 November 1996). This is a broadly applicable regulation. Among the topic areas, natural resources stewardship and ecosystem management are discussed. A Level 0 recommendation (no change needed) is made at this time. This recommendation could change to a Level 1 once further work on the ICP is completed.
- ER 1165-2-27: *Establishment of Wetlands Areas in Connection with Dredging* (18 August 1989). This ER refers to Section 150 of WRDA 1976; it established wetland areas as part of an authorized water resources development project. A Level 1 recommendation is made. It is recommended that information on ICs be incorporated, as appropriate, when this ER is updated. Because of the age of this ER, it is likely that the USACE will modify it in the near future.
- ER 1165-2-28: *Corps of Engineers Participation in Improvements for Environmental Quality* (30 April 1980). This ER addresses the relationship of the Environmental Quality (EQ) account in the Principles and Guidelines to Corps Water Resources Development, i.e., EQ measures must enhance, preserve, or restore the environment of the study area. Since the policy and procedure addressed in the ER were later expanded in other documents (e.g. Digest of Water Resources Policies and Authorities), a Level 0 recommendation is appropriate for this ER.

9.4 Key observations related to ecosystem restoration documents

A review of USACE documents conducted thus far provides a snapshot of current requirements and, to some extent, a historical perspective of changes that have occurred through time. These reviews constitute an initial step in examining incremental changes related to ecosystem restoration. As the ICP progresses, other documents from a variety of sources will also be reviewed.

A review of WRDAs from 1976 to 2007 was conducted to provide a historical perspective of ecosystem restoration. Each WRDA amendment establishes certain provisions pertaining to ecosystem restoration. For example, WRDA 1976 authorizes the Chief of Engineers to establish wetlands as part of an authorized water resources development. WRDA 1986 mentions conserving fish and wildlife habitat, authorized a two-year demonstration program to improve environmental quality, and specified a non-Federal cost share (25 percent) requirement. WRDA 1990 amended the demonstration program to a continuing program (project modifications for improvement of the environment). This Act also recognized environmental protection as one of the primary missions of the USACE.

Of the six reviewed documents related specifically to ecosystem restoration, four were recommended for Level 1 to incorporate the subject of incremental change. The remaining two documents were recommended for no change. None of the documents received a Level 2 recommendation (the document should be reorganized so that ICs become a central feature or an EC or EP could be produced that addresses the dynamic influence of ICs on the topic of this document). The priority recommendations for the four Level 1 documents were assigned as follows:

- EP 1165-2-502: *Ecosystem Restoration-Supporting Policy Information*, 30 September 1999 (initiate work in intermediate term: 3–6 months).
- ER 1165-2-501: *Civil Works Ecosystem Restoration Policy*, 30 September 1999 (initiate work in first part of the longer term: 6–9 months).
- ER 1165-2-27: *Establishment of Wetlands Areas in Connection with Dredging*, 18 August 1989 (initiate work in the longer term: 6–12 months).
- EP 1165-2-1: *Digest of Water Resources Policies and Authorities*, 30 July 1999 (beyond longer term; no specific date recommended).

This summary information is included in Table 13 (p 76).

10 Summary and Recommendations

This section has three main sub-sections. The first summarizes the institutional review results relative to both the four levels of action recommendations and a prioritized time schedule for addressing each recommendation. Because of the unanticipated large number of ERs and other types of documents that need to be modified or new documents prepared, a carefully developed strategy for addressing these action-based recommendations will be needed. Accordingly, the second sub-section delineates several strategies that could be utilized. Finally, the last sub-section contains several pragmatic recommendations for moving forward on a program to modify existing documents or develop new documents.

10.1 Summary of institutional review results

Table 13 summarizes the priorities for work initiations for 38 ERs and other documents. The recommendation levels for the 38 ERs and other documents included 28 Level 1s, one Level 2, five Level 3s, and four Level 4s. Level 1 denotes the introduction of incremental changes throughout the existing document or the issuance of a separate supporting ETL. The Level 2 recommendation denotes a reorganization of the existing document or the preparation of a corollary supporting EC or EP. The Level 3 recommendation specifically relates to five EMs; in these cases, either a new EM should be prepared or a supporting EP or ETL should be prepared to supplement the existing EM. Finally, because of the broad range of topics that would need to be addressed, the Level 4 recommendation involves the establishment of a separate USACE work group to study the topics and develop a document-specific approach that goes beyond the scope of this ICP. To illustrate the range of topics in addition to addressing incremental changes, it may be determined that adaptive management, environmental sustainability, climate change, and vertical datum levels should be incorporated in this group and other groups of documents.

Lower numbers associated with the periods for work initiation are reflective of documents with higher priority for attention. As shown in Table 13, four ERs are recommended for attention within 3 months of the approval of this Institutional Review Report. Further, 12 documents are proposed for initial attention in the 3- to 6-month period. A total of 18 documents are recommended for starting dates for revisions or new documents over a six-month period; three have a 6- to 9-month timeframe, seven are listed

for the 6- to 12-month period, and eight are shown for the 9- to 12-month period. No initiation time, other than beyond 12 months, was identified for ER 1105-2-100 (*Planning Guidance Notebook*), ER 200-2-2 (*Procedures for Implementing NEPA*), and two listings for EP 1165-2-1 (*Digest of Water Resources Policies and Authorities*). This undefined period reflects uncertainty as to when these ERs and EP will be subjected to necessary changes. Further, the assumption is made that ICs could be introduced at the same time that other changes are being promulgated.

Table 13. Summary of the prioritization order for work on the recommended levels of change for the reviewed regulations and other documents.

Document	Topical Category	Recommendation Level	Work Initiation
ER 1110-2-1150: <i>Engineering and Design for Civil Works Projects</i> , 31 August 1999 (DRF in App. B)	CC-GA	1	0-3
ER 1165-1-119: <i>Modifications to Completed Projects</i> , 20 September 1982 (DRF in App. D)	CC-RIC	1	0-3
ER 1165-2-21: <i>Flood Damage Reduction in Urban Areas</i> , 30 October 1980 (DRF in App. H)	FDRS-ER(+)	1	0-3
ER 1105-2-101: <i>Risk Analysis for Flood Damage Reduction Studies</i> , 3 January 2006 (DRF in App. H)	FDRS-ER(+)	1	0-3
ER 1110-2-6065: <i>Guidance for a Comprehensive Evaluation of Vertical Datums on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects</i> , 1 July 2007 (DRF in App. B)	CC-GA	1	3-6
EM 1110-2-1201: <i>Reservoir Water Quality Analysis</i> , 30 June 1987 (DRF in App. C)	CC-WQ	3	3-6
EM 1110-2-4000: <i>Sedimentation Investigations of Rivers and Reservoirs</i> , 31 October 1995 (DRF in App. C)	CC-WQ	3	3-6
ER 1110-2-100: <i>Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures</i> , 15 February 1995 (DRF in App. D)	CC-RIC	1	3-6
ER 1105-2-8154: <i>Water Quality and Environmental Management for Corps Civil Works Projects</i> , 31 May 1995 (DRF in App. D)	CC-RIC	2	3-6
EM 1110-2-2602: <i>Planning and Design of Navigation Locks</i> , 30 September 1995 (DRF in App. G)	IN-EM	4	3-6
EM 1110-2-2607: <i>Planning and Design of Navigation Dams</i> , 31 July 1995 (DRF in App. G)	IN-EM	4	3-6
EM 1110-2-5025: <i>Dredging and Dredged Material Disposal</i> , 25 March 1983 (DRF in App. G)	IN-EM	3	3-6
EM 1110-2-5026: <i>Beneficial Uses of Dredged Material</i> , 30 June 1987 (DRF in App. G)	IN-EM	3	3-6
ER 1165-2-26: <i>Implementation of Executive Order 11988 on Flood Plain Management</i> , 30 March 1984 (DRF in App. H)	FDRS-ER(+)	1	3-6 ^c
ER 1110-2-1464: <i>Hydrological Analysis of Watershed Runoff</i> , 30 June 1994 (DRF in App. H)	FDRS-ER(+)	1	3-6

Document	Topical Category	Recommendation Level	Work Initiation
EP 1165-2-502: Ecosystem Restoration – Supporting Policy Information, 30 September 1999 (DRF in App. K)	ER-ER(+)	1	3–6
EM 1110-2-1619: Risk-Based Analysis for Flood Damage Reduction Studies, 1 August 1996 (DRF in App. I)	FDRS-EM	1	6–9
ER 1165-2-501: <i>Civil Works Ecosystem Restoration Policy</i> , 30 September 1999 (DRF in App. K)	ER-ER(+)	1	6–9
ER 1130-2-530: <i>Flood Control Operations and Maintenance Policies</i> , 30 October 1996 (DRF in App. H)	FDRS-ER(+)	1	6–12
ER 1110-2-1405: <i>Hydraulic Design for Local Flood Protection Projects</i> , 30 September 1982 (DRF in App. H)	FDRS-ER(+)	1	6–12
ER 1110-8-2 (FR): <i>Inflow Design Floods for Dams and Reservoirs</i> , 1 March 1991 (DRF in App. H)	FDRS-ER(+)	1	6–12
ER 1130-2-550: <i>Recreation Operations and Maintenance Policies</i> , 30 March 2009 (DRF in App. H)	FDRS-ER(+)	1	6–12
EP 1130-2-550: Recreation Operations and Maintenance Guidance and Procedures, 30 August 2008 (DRF in App. H)	FDRS-ER(+)	1	6–12
EM 1110-2-1419: Hydrologic Engineering Requirements for Flood Damage Reduction Studies, 31 January 1995 (DRF in App. I)	FDRS-EM	1	6–12
EM 1110-2-1420: <i>Hydrologic Engineering Requirements for Reservoirs</i> , 31 October 1997 (DRF in App. I)	FDRS-EM	1	6–12
ER 1165-2-27: Establishment of Wetlands Areas in Connection with Dredging, 18 August 1989 (DRF in App. K)	ER-ER(+)	1	6–12
ER 1130-2-540: Environmental Stewardship Operations and Maintenance Guidance and Procedures, 15 November 1996 (DRF in App. B)	CC-GA	1	9–12
EM 1110-2-3600: <i>Management of Water Control Systems</i> , 30 November 1987 (DRF in App. C)	CC-WQ	3	9–12
ER 1110-2-240: <i>Water Quality Management</i> , 1 March 1994 (DRF in App. D)	CC-RIC	1	9–12
ER 1110-2-1457: Engineering and Design – Hydraulic Design of Small Boat Navigation Projects, 24 June 1985 (DRF in App. F)	IN-ER(+)	1	9–12
EM 1110-2-1605: <i>Hydraulic Design of Navigation Dams</i> , 12 May 1987 (DRF in App. G)	IN-EM	1	9–12
EM 1110-2-1417: <i>Flood Runoff Analysis</i> , 31 August 1994 (DRF in App. I)	FDRS-EM	1	9–12
EM 1110-2-1418: Channel Stability Assessment for Flood Control Projects, 31 October 1994 (DRF in App. I)	FDRS-EM	1	9–12
EM 1110-2-1205: Environmental Engineering for Flood Control Channels, 15 November 1989 (DRF in App. I)	FDRS-EM	1	9–12
ER 1105-2-100: <i>Planning Guidance Notebook</i> , 22 April 2000 (DRF in App. A)	CC-GA	4	12(+) ^d
ER 200-2-2: <i>Procedures for Implementing NEPA</i> , 4 March 1988 (DRF in App. B)	CC-GA	1	12(+) ^e
EP 1165-2-1: <i>Digest of Water Resources Policies and Authorities</i> , 30 July 1999, overall focus (DRF in App. A)	IN-ER	4	12(+) ^f

Document	Topical Category	Recommendation Level	Work Initiation
EP 1165-2-1: <i>Digest of Water Resources Policies and Authorities</i> , 30 July 1999 – Ch. 19 (Ecosystem Restoration) (DRF in App. K)	ER-ER(+)	1	12(+) ^f
<p>a: Category codes are as follows:</p> <p>CC-GA = cross-cutting issue with general applicability to three selected mission areas</p> <p>CC-WQ = cross-cutting issue related to water quantity and quality management for the three selected mission areas</p> <p>CC-RIC = cross-cutting issue that includes responses to incremental changes (for existing projects)</p> <p>FDRS-ER(+) = flood damage reduction study ERs and other documents</p> <p>FDRS-EM = flood damage reduction study EMs</p> <p>IN-ER(+) = inland navigation study ERs and other documents</p> <p>IN-EM = inland navigation study EMs</p> <p>ER-ER(+) = ecosystem restoration study ERs and other documents.</p> <p>b: The numbers in this column relate to the time period following acceptance of this report when work should be initiated on the recommendation level; the utilized numbers, in months, are as follows (the lower the number the higher the priority):</p> <p>0–3 months (near term)</p> <p>3–6 months (intermediate term)</p> <p>6–9 months (first half of longer term)</p> <p>6–12 months (longer term)</p> <p>9–12 months (second half of longer term).</p> <p>c: Depending on the timing of proposed changes in EO 11988, it might be necessary to initiate work on ER 1165-2-26 in the near term (0–3 months).</p> <p>d: It is anticipated that ER 1105-2-100 will be updated at some future date; when this occurs, ICs should be included as appropriate.</p> <p>e: It is anticipated that ER 200-2-2 will be updated at some future date; when this occurs ICs should be included as appropriate.</p> <p>f: It is anticipated that revisions in EP 1165-2-1 will be made in the near future but beyond a 12-month period.</p>			

Finally, the PDT did not anticipate that such a large number (38 out of the 65 total ERs and other documents reviewed) would receive action-level recommendations. One lesson from these results is that the topic of incremental changes applies to both general policies and guidance, as well as planning information related to the three selected mission areas (inland navigation, flood damage reduction, and ecosystem restoration).

10.2 Strategies for addressing the prioritized changes

It is recognized that modifications of 38 existing documents or the development of supporting documents (such as ECs, EPs, or ETLs) could be time consuming because of the technical content issues and compliance with USACE document creation or modification procedures. Accordingly, combinations of the following strategies could be considered to reduce the necessary time and budgetary requirements.

Strategy 1: Prepare an overarching, comprehensive report on ICs and their relationships with various planning, design, construction, and operational phases within a variety of USACE mission areas. This report would include descriptions of a variety of ICs and their implications for the above phases. Further, key information from peer-reviewed and other literature would be incorporated, along with summary descriptions and findings associated with a plethora of scientific methods and tools for evaluating the influences of ICs on the biophysical and socioeconomic environments. This report could be used as a resource for modifying existing documents or developing new documents. Further, information related to USACE protocols would need to be reviewed. Such protocols are delineated in the USACE's *Guidance for Preparation and Processing of USACE Command Publications* (USACE 1999c).

Strategy 2: Conduct a pilot-scale study of three to five selected documents and their recommendations, and utilize this information to develop protocols for preparing new documents or modifying existing ones. The recommendations for several key documents could be used to develop plans for their actual conduction. Then, with the pilot-scale protocols, projections of the time and costs associated with addressing each document in Table 13 could be developed. It is assumed that the overarching, comprehensive report described in Strategy 1 would be extensively used in Strategy 2.

Strategy 3: Utilize the Expert Elicitation Process (EEP) to facilitate an external review of work to date, to modify priorities as appropriate, and to reduce the number of documents assigned Level 1, 2, 3, or 4 recommendations. This EEP strategy was described for tasks associated with Objectives 1 and 2 in the proposal for this IC Project. Further, the EEP could also be used to re-prioritize the timing schedule of this IC Project.

Strategy 4: Use other options to achieve a wider USACE opinion survey relative to prioritizing the timing schedule as displayed in Table 13. Such options include electronic surveys and results compilation using software such as Surveymonkey.com or the use of a more comprehensive Delphi study aided by the use of Surveymonkey.com.

Strategy 5: Other options to be identified. One example would be the formation of work groups to address the documents receiving Level 4 recommendations.

10.3 Recommendations for accomplishing identified document changes or development

Based on the above summary of the recommendation levels in Table 13 and the delineated strategies for addressing the large number of documents (38) needing modifications, the following recommendations are made:

- A comprehensive report on incremental changes (Strategy 1), which will include information on case studies, methods, and tools, should be prepared. This report could be used as a reference document to promote informational consistency when various documents are changed or new ETLs, ECs, EPs, or EMs are prepared.
- The EEP should be used to review this Institutional Review Report and aid in the development of both current state conditions and desired future conditions (Strategy 3). Further, it might be possible to reduce the number of documents assigned action-level recommendations.
- It is important to recognize that numerous ERs and other documents may need to be modified based on the results of several PDTs under Goal 2 of the USACE Campaign Plan. In addition to incremental changes, additional topics that could be added to existing documents include adaptive management, environmental sustainability, climate change, and vertical datum levels. Accordingly, this recommendation would need to be considered by the overall PDT for Theme 1 (AFC).
- Because of their broad influence on water resources planning across all mission areas, the following five documents from Table 13 need special consideration: ER 1110-2-1150 (*Engineering and Design for Civil Works Projects*), ER 1165-1-119 (*Modifications to Completed Projects*), ER 1105-2-100 (*Planning Guidance Notebook*), ER 200-2-2 (*Procedures for Implementing NEPA*), and EP 1165-2-1 (*Digest of Water Resources Policies and Authorities*). The special consideration, which could be provided by the overall PDT for Theme 1 (AFC), could include the establishment of special work groups to address the timing and new topical coverage for each of these five documents. In addition, coordination between these groups would enable the development of an overall timing strategy for the inclusion of new topical information in each document.
- The pilot-scale study from Strategy 2 above should be implemented by this PDT. This strategy would facilitate the development of an overall plan for addressing the action-level recommendations in Table 13.

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Appendix A: Recommendations on Two Overarching Guidance Documents Related to Civil Works Projects

ER 1105-2-100, *Planning Guidance Notebook*, 22 April 2000

Description

This regulation provides the overall direction by which USACE Civil Works projects are formulated, evaluated, and selected for implementation. It contains a description of the USACE planning process, USACE missions and programs, specific policies applicable to each mission and program, and analytical requirements. Its fundamental purpose is to describe the planning process in a straightforward, plain-language manner.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied in several places. Examples include:

- “This engineer regulation supersedes ER 1105-2-100 dated 28 December 1990.”
- “Plans may be formulated which require changes in existing statutes, administrative regulations, and established common law; such required changes are to be identified.”
- “The version of this regulation on the web site is the official and current version. Every effort will be made to notify users when this regulation is updated.”
- “Problems and opportunities statements will encompass current as well as future conditions and are dynamic in nature. Thus, they can be, and usually are, re-evaluated and modified in subsequent steps and iterations of the planning process.”
- “Gathering information about potential future conditions requires forecasts, which should be made for selected years over the period of analysis to indicate how changes in economic and other conditions are likely to have an impact on problems and opportunities.”
- “Plans should be in compliance with existing statutes, administrative regulations, and common law or include proposals for changes as appropriate.”

- “Planners can pursue the use of alternative procedures when these would provide a more accurate estimate of benefits. The use of alternative procedures and the consideration of new benefit categories, including the procedures to be used to estimate them, require advance approval from HQUSACE (CECW-P).”
- “Forecasts of future without-project conditions shall consider all other actions, plans and programs that would be implemented in the future to address the problems and opportunities in the study area in the absence of a Corps project. Forecasts should extend from the base year (the year when the proposed project is expected to be operational) to the end of the period of analysis.”
- “Expected environmental conditions, especially trends in ecosystem change, shall be considered in forecasting with- and without-project conditions. Forecasted environmental conditions can be based on a variety of different sources of information available from Federal, State and other natural resource management agencies and private conservation entities.”
- “A risk-based approach to water resources planning captures and quantifies the extent of risk and uncertainty in the various planning and design components of an investment project.”
- “A number of Federal laws, such as the National Environmental Policy Act of 1969, the Clean Water Act of 1977, as amended and Section 122 of the 1970 River and Harbor and Flood Control Act require consideration of a wide range of effects in planning and decision making.”
- “We also should take into account: the interconnectedness of water and land resources (a systems approach); the dynamic nature of the economy and the environment; and the variability of social interests over time. Specifically, Civil Works planning should consider the sustainability of future watershed resources, specifically taking into account environmental quality, economic development and social well-being.”
- “The WRDA of 1986, established new cost sharing rules for all studies and projects conducted by the Corps. The cost sharing provisions of the WRDA of 1986 place greater financial responsibilities on non-Federal sponsors of Corps projects.”
- “Section 203 of the WRDA of 1996 allows a non-Federal sponsor to defer its cost contribution for excess study costs that are not attributable to changes in Federal law or changes in scope requested by the sponsor, until the execution of a Project Cooperation Agreement.”
- “Advances in technology affecting the transportation industry over the period of analysis should be considered, within reason.”

- “Changes in the cost functions and demand schedules in the current and future without-project condition and the current and future with-project condition are analyzed. The impact of uncertainty in the use of the harbor, the level of service provided and existing and future inventories of vessels are also considered.”
- “Section 73 of the Water Resources Development Act of 1974 requires consideration of nonstructural alternatives in flood damage reduction studies.”
- “Executive Order 11988 (E.O. 11988) was issued in 1977 with the intent to avoid floodplain development, reduce hazards and risk associated with floods, and restore and preserve natural floodplain values (See ER 1165-2-26 for Corps policy on this directive).”
- “Future flood damages are those damages to activities identified in Step 3 that might use the floodplain in the future with- and without project conditions. Hydrologic and economic changes are considered in developing these estimates.”
- “Section 219 of the WRDA of 1999 directs the Secretary of the Army to calculate benefits for nonstructural flood damage reduction projects using methods similar to those used in calculating the benefits of structural projects and further directs the Secretary to avoid double counting of benefits in these projects.”
- “In accordance with Public Law 826 of 1956 (Beach Nourishment), when the Chief of Engineers determines that the most suitable and economical remedial measures would be provided by a periodic nourishment project, the Chief may consider the periodic nourishment as continuing construction for the length of time that the Chief specifies.”
- “Section 215(b) of the WRDA of 1999 amended Section 8(k)(2)(B) of the Outer Continental Shelf Lands Act to exempt state and local government agencies, in addition to Federal agencies, from the assessment of fees for the use of Outer Continental Shelf sand, gravel, and shell resources in a shore protection, beach restoration, or coastal wetlands project or program, or in any other construction project funded or authorized by the Federal Government.”
- “The Corps of Engineers incorporated ecosystem restoration as a project purpose within the Civil Works program in response to the increasing National emphasis on environmental restoration and preservation.”
- “Congress, through various statutes, has directed the Corps to consider the development of hydroelectric power in conjunction with other water resources development plans. Current policy calls for the Corps to

- formulate comprehensive plans including the development of hydro-power by a non-Federal sponsor.”
- “Storage reallocation for recreation which significantly affects other authorized purposes, or involves major structural or operational changes, requires Congressional approval.”
 - “Existing Corps projects may be modified to add storage for municipal and industrial water supply. Storage may also be reallocated from other purposes to municipal and industrial uses.”
 - “Under the authority of Public Law 88-140 of 1963 (Extension of Right to Water Supply Storage), the non-Federal sponsor acquires a permanent right to the use of storage as long as the space is physically available.”
 - “Under Section 6 of the Flood Control Act of 1944, the Secretary of the Army is authorized to make agreements with states, municipalities, private concerns, or individuals for surplus water that may be available at any reservoir under the control of the Department.”
 - “Reallocation or addition of storage that would seriously affect other authorized purposes or that would involve major structural or operational changes requires Congressional approval.”
 - “When water supply storage is added to an existing project and storage is not reallocated, a willingness to pay concept is used to assign costs to the new water supply purpose.”
 - “The SCRB method is also applicable for multi-purpose projects that include ecosystem restoration as a project purpose. Guidance on this application is under development. If the need for a cost allocation analysis for this type of project is foreseen, contact CECW-PD for additional guidance, preferably during the early phases of the study.”
 - “Section 216 of the River and Harbor and Flood Control Act of 1970 authorizes investigations for modification of completed projects or their operation when found advisable due to significantly changed physical or economic conditions and for improving the quality of the environment in the overall public interest.”
 - “Section 212 of the WRDA of 1999 provides programmatic authority for the Secretary of the Army to implement projects that reduce flood hazards and restore the natural function and values of rivers within certain specified limits. The program emphasizes the use of nonstructural approaches to flood damage reduction and coordination with FEMA and other Federal, State, and local agencies, and Native American Nations.”
 - “General authorities are contained in Section 216 of the Flood Control Act of 1970 and Section 2 of the Fish and Wildlife Coordination Act of

1958. Section 216 authorizes investigations for modification of completed projects or their operation. Section 2 allows investigation of modifications to projects that were not substantially completed prior to August 1958 in the interest of conservation of fish and wildlife.”
- “Studies may be necessary if a significant period of time has elapsed or conditions have changed significantly since the feasibility study was completed.”
 - “General Reevaluation. This is reanalysis of a previously completed study, using current planning criteria and policies, which is required due to changed conditions and/or assumptions. The results may affirm the previous plan; reformulate and modify it, as appropriate; or find that no plan is currently justified. The results of the study are documented in a General Reevaluation Report (GRR).”
 - “Limited Reevaluation. This study provides an evaluation of a specific portion of a plan under current policies, criteria and guidelines, and may be limited to economics, environmental effects or, in rare cases, project formulation. A Limited Reevaluation Report (LRR) documents the results of the analysis undertaken.”
 - “An Engineering Documentation Report (EDR) may also be prepared to support the PCA when there are minor changes in design and costs from the authorizing reports. The EDR may also be used in lieu of a GRR to document other information not included in a decision document when project reformulation is not required and the changes are only technical changes.”
 - “The scope and nature of the changes in the environmental effects of the project identified as a result of acquisition of new information, of changed conditions, or changes in the project will determine the appropriate type of NEPA documentation.”
 - “General authorities allow for the addition of project purposes, under certain circumstances, without specific Congressional authorization. These purposes include water supply, recreation, fish and wildlife enhancement (except for land acquisition), and low flow augmentation for purposes other than water quality. Additionally, there is authority for adding minimum provisions for future hydroelectric power, and conservation of threatened and endangered species.”
 - “Section 902 of the WRDA of 1986, as amended, legislates a maximum total project cost. Projects to which this limitation applies and for which increases in costs exceed the limitations established by Section 902, as amended, will require further authorization by Congress raising the maximum cost established for the project.”

- “Section 710 of the WRDA of 1986 requires an annual submission to Congress of a list of authorized but incomplete water resources studies which have not had funds appropriated during the preceding five full fiscal years.”
- “Section 1001 of the WRDA of 1986 as amended, provides for the deauthorization of water resources projects on which Federal funds for planning, design or construction have not been obligated for 7 fiscal years.”

Why should ICs be addressed?

ICs occur for a wide variety of reasons but generally are due to changes in law (authorities) or environmental conditions. This ER serves primarily to provide a concise description of currently existing requirements for planning rather than to describe the evolution of such requirements. As such, discussion of ICs should focus primarily on recent changes from previous requirements.

Recommendation

The term IC should be defined, added, and explained in appropriate places throughout the regulation. In addition, because each WRDA amends several previous authorities, policies, or processes applicable to the USACE, this ER should be scheduled for revision, or, at a minimum, a means of supplementation, each time a new WRDA is enacted. The current ER has not been updated to reflect ICs brought about by WRDA 2000 or WRDA 2007. Therefore, ER 1105-2-100 is recommended for Level 4 (establish a work group to study the concerns and develop the recommended solutions to identified problems beyond the scope of the ICP).

EP 1165-2-1, Digest of Water Resources Policies and Authorities, 30 July 1999

Description

This pamphlet provides a brief summary, in digest form, of the existing administrative and legislative water resources policies and authorities pertinent to the Civil Works activities of the USACE.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, the EP is a comprehensive compendium of legislative, Executive, policy, and procedural directives and changes to these directives that shape the current inland navigation pro-

gram of the USACE. As this EP documents inland navigation program changes too numerous to include here, only a few of the major historical changes are provided below as examples:

- **Commerce Power.** Federal commerce authority includes navigation, and Congress has jurisdiction over all navigable waters of the U.S. This power may be extended to nonnavigable waterways and tributaries if the navigable capacity of the navigable waterway or interstate commerce is affected.
- **The Navigation Servitude.** This sovereign power allows the Federal Government to use lands under navigable waters for navigation-related purposes without payment under the Fifth Amendment. The power includes the right to remove any structures within the servitude. The navigation servitude is derived from rights recognized under Roman civil law and English common law for the public to use navigable waterways without payment, despite the private ownership of the bed or bank. The navigation servitude was incorporated into United States law as part of the Commerce Power under the U.S. Constitution. Hence, in exercise of Congress's power over navigation stemming from the Commerce clause of the Constitution, no further Federal real estate interest is required for navigation projects in navigable waters below the ordinary high water mark. Further, the courts have also generally held that, under the navigation servitude, claims of consequential damages arising from Federal development for navigation, with respect to property values or otherwise, are not compensable. However, Congress has, to a degree, foregone that advantage through what some may view as a definition of compensation for Federal real property acquisitions (Section 111, Public Law 91-611, 31 December 1970) and the definition of non-Federal sponsor cost-sharing requirements (Title I of Public Law 99-662, 17 November 1986).
- **Acts of Congress, and interpretations thereof by the Supreme Court,** clearly indicate that the Federal Government may participate to some degree in all aspects of water and related land conservation, development, and management.
- **Dynamic Nature of Federal Policy.** Legislative enactments reflect both long- and short-range national priorities and require progressive adaptation. Rigid policies are undesirable when dealing with resources that affect the well-being of our people and that have broad economic, environmental, and social implications. Changing technology and public priorities require flexible policies and informed leadership to meet urgent needs and to assure the welfare of future generations.

- The tendency has been for Congress to gradually increase Federal responsibility in response to needs of the times. Some water resources project purposes were originally established through specific legislation. Others were established as a result of repetitive Congressional authorization of projects containing resource purposes incidental to the “primary” project purposes. Legislation pertinent to the water resources program of the USACE is listed in Appendix B.
- Generally, water resource developments recommended to the Congress in response to study authorities may not be implemented without being specifically adopted in law. The majority of the USACE water resources projects or programs fall into that category.
- Legislative Landmarks. The USACE’s Civil Works responsibility began with an Act of Congress in 1824 for the improvement of rivers and harbors for navigation. This led to legislation in 1879 creating the Mississippi River Commission and establishment of the Board of Engineers for Rivers and Harbors (BERH) in 1902. (The BERH ceased to exist in 1993 in accordance with Section 223 of WRDA 1992.)
- Section 107 of the 1960 River and Harbor Act established a Continuing Authority for development of small navigation projects.
- The Water Resources Development Act (WRDA) of 1986 is the legislative landmark of major current significance. In it, the Congress has comprehensively reestablished and redefined, by purpose, the Federal interest in water resources development and has, in recognition of the limitations on Federal financial resources in an era of persistent budgetary deficits, instituted requirements for proportionately greater non-Federal cost sharing in USACE projects.
- During the 1970s there was a qualitative change in public policy toward resource planning and development, spurred by the recognition that the Nation’s natural resources are both interrelated and finite. Considerations other than economic efficiency evolved. Among others, this legislation includes:
 - The Clean Water Act of 1977 (Public Law 95-217)
 - Water Resources Development Act of 1976 (Public Law 94-587)
 - Water Resources Development Act of 1974 (Public Law 93-251)
 - River and Harbor and Flood Control Act of 1970 (Public Law 91-611)
 - National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190).
- Water Resources Council (WRC). The WRC was created as an independent agency by the Water Resources Planning Act, Public Law 89-80, 22 July 1965. Section 103 of the Act directs WRC to promulgate, with

- the approval of the President, principles, standards, and procedures for water and related land resources planning for use by member agencies.
- The President's Council on Environmental Quality (CEQ) was established by Section 202 of the National Environmental Policy Act (NEPA) of 1969. The CEQ advises and assists the President in providing leadership in protecting and enhancing the quality of the Nation's environment. It develops and evaluates Federal policies and activities on environmental quality. One of CEQ's primary functions in relation to water resources is the preparation of regulations concerning the development of environmental impact statements developed by the USACE and other agencies.
 - Administrative policy has developed gradually but continuously over the years to implement laws and to encompass the growth of economic and social need and changing technology.
 - In September 1973 the President approved (and WRC published in the *Federal Register*) WRC's *Principles and Standards for Planning Water and Related Land Resources* (P&S). On 10 March 1983 all of the elements of P&S were repealed (48 FR 10250) and notice of adoption and availability of the new *Principles and Guidelines* (P&G) issued (48 FR 10259) in the *Federal Register*. The new principles differ from the previous P&S most notably in that they prescribe a single Federal objective, national economic development (NED), and do not specifically characterize other plans that must be in the array of alternatives considered.
 - Federal courts clarify and define the responsibilities and limitations placed on the USACE's Civil Works activities by Federal statutes and the Constitution. Judicial decisions have affected Civil Works policies in several major areas: basic authority to construct or operate projects, administrative practices and required factors of consideration in project construction and operation (including environmental factors), and the scope and application of regulatory authorities.
 - Congressionally approved USACE projects must have been authorized in exercise of one of the powers granted to Congress by the Constitution. Such authorizations are generally based on the Congressional powers to regulate interstate and foreign commerce or to tax and spend for the general welfare. Major Supreme Court decisions have established that those general powers include the power not only to promote navigation, but also to provide for flood damage reduction, hydropower production, watershed development, and similar activities of broad water resources management. Furthermore, the powers can be applied by

Congress not only to the main portions of a river or other body of water, but to its watershed and non-navigable portions as well.

- In recent years judicial effects on policy have been most pronounced in matters of administrative procedures, particularly those involving public participation in decision-making and related environmental questions. The provisions of the NEPA have been applied by the courts to virtually the whole scope of the planning, construction, and operation of water resources projects, resulting in numerous changes in agencies' basic procedures. Because of this increased judicial scrutiny that occurred in the early 1970s, individuals and groups affected by present or proposed projects will have a continued opportunity to use the courts to test the propriety and application of administrative procedures.
- USACE regulatory authorities have been interpreted by the courts to require detailed attention to systematic decision-making and protection of the interests of the public at large, as well as the particular interests of the persons or entities subjected to Federal regulation. The policies governing the administrative procedures in USACE regulatory programs have accordingly become increasingly detailed.
- Chapter 3 discusses current general policies of the USACE as of the date of publication of EP 1165-2-1. Since this EP was approved, two WRDAs have been enacted. The EP is currently undergoing revision, although possible changes are not reflected in the current review.
- The merits of Civil Works projects for improving navigation are currently measured against a single Federal objective (national economic development) in accord with the Water Resources Council's (WRC) *Principles and Guidelines* (P&G).
- Until passage of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-662), commercial navigation improvements were constructed, operated, and maintained by 100 percent Federal funding (except for land and relocations requirements). Such projects authorized by that Act, and subsequently, may involve local cost sharing. Non-Federal cost sharing for recreational navigation projects has always been the norm.
- Section 204(f) of WRDA 1986, as amended, as implemented by ER 1165-2-124, provides the basis for the Federal assumption of maintenance of navigation (harbor) projects constructed by non-Federal interests.
- The Corps defines navigable waters as "...those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce."

- By Act of 10 February 1932 (47 Stat. 42, 33 U.S.C. 541), Congress expanded the definition of waterborne commerce to “include the use of waterways by seasonal passenger craft, yachts, house boats, fishing boats, motor boats and other similar watercraft, whether or not operated for hire.”
- Pursuant to WRDA 1986, Federal user charges will be assessed for use of certain waterways (fuel tax) and harbors (harbor maintenance tax), and project sponsors may assess local user fees to recover their cost share.
- Section 119 of the River and Harbor Act of 1970 (Public Law 91-611), states, “The Chief of Engineers, for the purpose of determining Federal and non-Federal cost-sharing, relating to proposed construction of small-boat navigation projects, shall consider charter fishing craft as commercial vessels.”
- Section 230 of WRDA 1996 directs the USACE to categorize all benefits generated by cruise ships as commercial navigation benefits. Benefits of navigation improvements affecting cruise ships arise from more efficient ship operations and increased tourism or enhanced tourism experience. Prior to WRDA 1996, efficiency improvement was classified as commercial navigation and improved tourism was classified as recreation.
- For waterway projects included within the definition of the “Inland Waterway System,” all requirements for project development are Federal. Federal participation in other navigation projects, based on the cost sharing provisions of WRDA 1986, as amended, is limited to sharing costs for design and construction of the general navigation features (GNF) consisting of breakwaters and jetties, entrance and primary access channels, turning basins, anchorage areas, structures designed to protect the channel from shoreline erosion, locks, and land-based and aquatic dredged material disposal areas.
- The cost sharing provisions of WRDA 1986 require non-Federal participation (50 percent) in the costs for preauthorization feasibility studies, except for studies of waterways included within the definition of the “Inland Waterways System.”
- Section 101 of WRDA 1986, as amended, requires the project sponsor to bear a percentage share of harbor construction costs for project components that are cost-shared (general navigation features, mitigation) according to the range of water depths where the work is done (20 feet or less, greater than 20 feet but not in excess of 45 feet, and greater than 45 feet).

- Waterways that are determined to be “inland waterways” for the purpose of Section 102 of WRDA 1986 are exempt from cost sharing, and construction and O&M are 100 percent Federal.
- Section 2 of the River and Harbor Act of 5 June 1920 provides that the Chief of Engineers, in recommending navigation improvements, shall make a determination of the general versus the special interest in an improvement and recommend an appropriate sharing of costs between Federal and non-Federal interests. The cost sharing prescribed by WRDA 1986 will be the basis for such recommendations.
- Consideration will be given to providing barge mooring at Federal cost when it can be demonstrated that such facility is required and necessary for safe and efficient use of a Federal navigation project. Examples would be provision of a mooring to permit reshaping a tow for: (a) safe and efficient passage through a navigation lock; (b) safe passage through congested Federal channel areas; or (c) safer passage crossing exposed waters. The advanced approval of HQUSACE must be obtained before such facilities are recommended at Federal cost.
- Section 108 of Public Law 86-645 authorizes the Secretary of the Army (notwithstanding the provisions of the Federal Property and Administrative Services Act of 1949, as amended, with respect to disposal of surplus property) to convey land that is a part of a water resources development project to a state or other public body for the purpose of developing or encouraging the development of public port or industrial facilities.
- Section 202 of the Inland Waterways Revenue Act of 1978 (Public Law 95-502) imposes an excise tax on fuel used by certain commercial cargo vessels using specified inland or intracoastal waterways of the United States. This law was amended 17 November 1986, by Section 1404 of WRDA 1986 (Public Law 99-662), increasing the tax schedule and adding the Tennessee-Tombigbee Waterway to the original list of taxable waterways. The Inland Waterways Tax applies only to those segments of the inland waterways specified in Section 206 of Public Law 95-502 as amended and are differentiated from coastal harbors, Great Lakes channels and harbors, and deep-draft segments of certain inland rivers.
- Section 1405 of WRDA 1986 amended Sections 203 and 204 of Public Law 95-502, which originally established the Inland Waterways Trust Fund (IWTF). Expenditures from the fund may be made available, as provided by appropriation acts, for making construction and rehabilitation expenditures for navigation on those Inland Waterways described in Section 206 of Public Law 95-502 as amended. It is the poli-

cy of the USACE that these projects be cost-shared 50 percent from the IWTF.

- Section 302 of WRDA 1986 established an Inland Waterways Users Board of eleven members, representing both shippers and primary users, to be selected by the Secretary of the Army. The Users Board is to make recommendations to the Secretary regarding construction and rehabilitation priorities and spending levels on the commercial navigational features and components of the inland waterways and inland harbors of the U.S.
- The definition of major rehabilitation relating to inland and intracoastal waterways of the U.S. is provided in Section 205 of WRDA 1992.
- Section 4 of the River and Harbor Act of 1894, as amended (33 U.S.C.), authorizes the USACE to publish regulations governing the use of navigable waters, except where authority is specifically delegated to another Federal agency. Regulations for specific waterways and for locks and dams are published in 33 CFR 207. Certain restricted areas are regulated in 33 CFR 334. Restricted areas for hazardous waters at dams and other Civil Works structures are defined in ER 1130-2-520.
- Section 1 of the Army Appropriation Act of 1919(33 U.S.C. 3) authorizes the USACE to establish danger zones and regulate navigation in areas likely to be endangered by target practice or other military operations. Regulations for specific danger zones are published in 33 CFR 334.
- Removal of sunken vessels or other similar obstructions is governed by Sections 15, 19, and 20 of the River and Harbor Act of 1899, as amended. Primary responsibility for removal belongs to the owner, operator, or lessee. If the obstruction is a hazard to navigation and removal is not undertaken promptly and diligently, the USACE may obtain a court judgment requiring removal, or it may remove the wreck and seek reimbursement for the full cost of removal and disposal.
- Public Law 85-480 authorizes publication and sale of navigation charts generally and requires that charges to the public for copies cover the cost of printing.
- Unless otherwise provided in the project authorization, channel depths specified will be construed as actual dredging limits (exclusive of over-depth dredging) and not as the draft limit of vessels to be accommodated. In planning for initial development of authorized channels, channel widths specified shall (in accordance with Section 5 of the 1915 River and Harbor Act) be understood to admit of such increases at the entrances, bends, sidings, and turning places as necessary to allow for the free movement of vessels.

- Maintenance dredging efforts of the USACE are governed by the environmental compliance requirements and procedures set forth in 33 CFR 335-338. Section 404(t) of the CWA authorizes any state to regulate, in accordance with its laws, the discharge of dredged material in any portion of the navigable waters within the jurisdiction of the state that results from maintenance dredging involving USACE navigation projects. District commanders obtain state water quality certification and a permit for disposal of maintenance dredged material required by Section 404(t) unless the state elects to waive these requirements. No maintenance dredging is performed unless disposal activities are in full compliance with state requirements or unless a waiver from those requirements is obtained pursuant to Section 404(t) and Section 511(a).
- Section 204 of WRDA 1992 (Public Law 102-580) authorizes the Secretary of the Army to carry out projects for the protection, restoration, and creation of aquatic and ecologically related habitats, including wetlands in connection with dredging for construction, operation, or maintenance of an authorized Federal navigation project.
- Section 4 of the River and Harbor Act, approved 5 July 1884, as amended by Section 6 of the River and Harbor Act, approved 3 March 1909, provides in part that whenever, in the judgment of the Secretary of the Army, the condition of any of the navigation works of the U.S. is such that its entire reconstruction is absolutely essential to its efficient and economical maintenance and operation, the reconstruction thereof may include such modifications in plan and location as may be necessary to provide adequate facilities for existing navigation, provided that the modifications are necessary to make the reconstructed work conform to similar works previously authorized by Congress and forming a part of the same improvement, and that such modifications shall be considered and approved by the Chief of Engineers before the work of reconstruction is commenced. Use of the 1909 authority will be for essential repairs, rehabilitation, replacement, or reconstruction of existing navigation structures that are required for continued use of the project for authorized purposes and that do not change the authorized project in scope, scale, or location. Also included under the 1909 authority are measures to improve operational efficiency such as modernization of operating equipment. The 1909 Act authority will not be used where it is determined that the necessary reconstruction work includes improvements, additions, or betterments that constitute a change in project purpose, size, location, or increased capacity beyond that obtainable from improved operational efficiency. In recent years, use of the 1909 Act authority has been rare. Extensive repair work on

existing projects has been accomplished as major rehabilitation. Section 205 of WRDA 1992 (Public Law 102-580) addresses the funding of major rehabilitation modifications to enhance operating efficiency beyond the original project design.

- Section 203 of WRDA 1986 permits a non-Federal interest to undertake a study of a harbor or inland harbor improvement for the purpose of getting the work authorized by Congress.
- The authority for non-Federal construction of harbor and inland harbor projects by non-Federal interests is contained in Section 204 of WRDA 1986, as amended, in Sections 204(a) through (g).
- Section 204(e) (O&M) of WRDA 1986 gives the Secretary of the Army responsibility for O&M of any project constructed by non-Federal interests under Section 204(a), Section 204(d), or Section 204(e) (Reimbursement) of WRDA 86, provided that before construction, the Secretary determines that the proposed work is economically justified and environmentally acceptable.
- Where measures are formulated to serve both HSDR and navigation, an allocation of multiple-purpose joint costs must be made and the joint costs shared in accordance with the purpose to which they are allocated along with any specific costs for features that serve only one purpose.

Why should ICs be addressed?

Additional reviews of this EP are being conducted for USACE missions in Flood Damage Reduction and Ecosystem Restoration. Also, this EP is undergoing revision; however, possible changes to the EP are not reflected in the current review. Because this EP provides important documentation of historical changes, amendments, modifications, clarifications, etc., on virtually every aspect of USACE missions, the revised EP should specifically discuss such changes as being incremental changes.

Recommendation

Level 4: The work group already studying revision of this EP should describe ICs for inland navigation. One possibility for presentation in the revised EP would be to construct a time line or series of time lines illustrating sequence of ICs that now shape program requirements.

Appendix B: Recommendations on Nine Regulations and Related Documents that are Cross-Cutting Relative to the Three Mission Areas

ER 1110-2-1150, Engineering and Design for Civil Works Projects, 31 August 1999

Description

This ER defines engineering responsibilities, requirements, and procedures during five phases of Civil Works projects: reconnaissance, feasibility, preconstruction engineering and design, construction, and operations. These phases are important because all regulations and policy documents being reviewed are related to one or more of the phases. Further, a brief section on the Continuing Authorities Program is included.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied in several places; examples are associated with reference to hydrology and hydraulic studies (Section 13.2.1), development of data for the environmental assessment (13.2.2), establishment of the preliminary design (13.2.3), operation and maintenance considerations (13.8), operational deviations from the plan (16.4), and existing project deficiencies (16.5). They are also implied in relation to the Continuing Authorities Program (Section 18).

Why should ICs be addressed?

ICs are relevant to all five phases of Civil Works projects. They should be addressed in defining needs and opportunities, in the selection of design parameters, and in operational plans. Further, such changes could be causative factors that initiate the use of the Continuing Authorities Program. The addition of information on ICs will aid the development of improved designs and operational plans.

Recommendation

The term IC should be defined and added and explained at appropriate places within the description of the five phases. Further, it should also be added, as appropriate, in the Continuing Authorities Program. This is a

Level 1 recommendation, which denotes the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL clarifying and explaining ICs in relation to the contents of ER1110-2-1150.

ER 200-1-5, Policy for Implementation and Integrated Application of the U.S. Army Corps of Engineers (USACE) Environmental Operating Principles (EOPs) and Doctrine, 30 October 2003

Description

This ER delineates the USACE's environmental operating principles (EOPs) and addresses how they can be incorporated throughout all missions, including water resources projects. Seven specific EOPs are noted: (1) strive to achieve environmental sustainability; (2) recognize the interdependence of life and the physical environment; (3) seek balance and synergy among human development activities and natural systems; (4) continue to accept corporate responsibility and accountability under the law; (5) seek ways and means to assess and mitigate cumulative impacts to the environment; (6) build and share an integrated scientific, economic, and social knowledge base; and (7) respect the views of individuals and groups interested in USACE activities. The ER elaborates on these seven EOPs. Further, it includes a Program Management Plan for integrating the EOPs within HQUSACE and its various mission areas.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied throughout.

Why should ICs be addressed?

This broad ER provides sufficient flexibility for incorporating ICs into USACE project planning and implementation. At this time, no modifications of the ER are deemed to be necessary.

Recommendation

IC-related information is not required for ER 200-1-5, so no recommendation for change is made relative to this ER (Level 0 Recommendation).

ER 200-2-2, Procedures for Implementing NEPA, 4 March 1988**Description**

This ER provides guidance for the Civil Works program relative to the implementation of the procedural provisions of the National Environmental Policy Act. Frequent references are made to the Council on Environmental Quality's NEPA Regulations at 40 CFR Parts 1500 to 1508. This ER highlights the preparation of EISs, environmental assessments, and categorical exclusions.

Are incremental changes (ICs) mentioned?

ICs are implied in Subject No. 6 (Actions Normally Requiring an EIS), subparts (b) and (c). Subpart (b) indicates that an EIS is normally required for proposed changes in existing projects that substantially increase their size or add additional purposes. Subpart (c) does likewise for proposed major changes in the operation and/or maintenance of completed projects.

Why should ICs be addressed?

As noted above, ICs could be triggers for the preparation of EISs on the impacts of changes in existing projects. Further, ICs could be addressed in relation to NEPA compliance documents for new projects.

Recommendation

Upon completion of further work on this IC project, consideration could be given to the appropriate addition of direct or inferred referrals to ICs in this ER. ICs should be introduced and added, as appropriate, throughout the document or an ETL should be issued to clarify and explain ICs in relation to the contents of ER 200-2-2 (Level 1 Recommendation). However, this determination should be postponed until the completion of this IC project.

ER 200-2-3, Environmental Compliance Policies, 30 October 1996**Description**

This ER establishes policies for environmental management at USACE Civil Works and Military projects. The categories of compliance are related to air pollutant emissions management; cultural resources management; hazardous materials and hazardous waste management; natural resources

management; solid waste management; wastewater management; water quality management; pesticides management; storage tank management; toxic surfaces management; petroleum, oil, and lubricant management; and several other topics. This ER is also related to ER 1130-2-540 (*Environmental Stewardship – Operations and Maintenance Policies*).

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned nor inferred in this ER. Further, due to the focus on topical environmental management, it is unlikely that ICs would need to be addressed relative to Civil Works projects.

Why should ICs be addressed?

As noted above, referrals to ICs related to Civil Works projects are not necessary in this ER.

Recommendation

IC-related information is not required for ER 200-2-3, thus no recommendation for change is made relative to this ER. (Level 0 Recommendation.)

EP 200-2-3, Environmental Compliance Guidance and Procedures, 30 October 1996

Description

This Engineer Pamphlet contains supporting technical guidance and procedures related to environmental compliance-related operations and maintenance activities at USACE Civil Works and Military projects and facilities. This EP supplements information in ER 200-2-3.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned nor are they implied in this EP. Further, because of the focus on topical environmental management, it is unlikely that ICs would need to be addressed relative to Civil Works projects.

Why should ICs be addressed?

As noted above, referrals to ICs related to Civil Works projects are not necessary in this EP.

Recommendation

IC-related information is not required for EP 200-2-3, so no recommendation for change is made relative to this EP (Level 0 Recommendation).

ER 1130-2-540, Environmental Stewardship -- Operations and Maintenance Policies, 15 November 1996**Description**

This ER establishes land management policy for USACE-administered project lands and water. Chapter 2 addresses natural resources stewardship; Chapter 4 highlights forest pest suppression assistance at Civil Works water resources development projects; and Chapter 6 focuses on cultural resources management. The information in Chapters 2, 4, and 6 may need to be addressed in EISs or environmental assessments prepared under the auspices of ER 200-2-2.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied in Chapters 2 and 6. Pending the findings of the IC Project, it might be appropriate to add relevant IC information to Chapters 2 and 6.

Why should ICs be addressed?

ICs can influence stewardship programs related to natural and cultural resources. For example, such changes could prompt modifications in specific program efforts related to Chapter 2 topics, such as ecosystem management, forest and woodland management, fish and wildlife management, grassland management, wetlands management, and soils management.

Recommendation

Upon completion of further work on this IC project, consideration could be given to the appropriate addition of direct or implied referrals to ICs in this ER. (This is a Level 1 Recommendation, which denotes the introduction of ICs and their addition, as appropriate, throughout the document or the issuance of an ETL clarifying and explaining ICs in relation to the contents of ER 1130-2-540; however, this determination should be postponed until the completion of further work on this IC project.)

EP 1110-1-16, Handbook for the Preparation of Storm Water Pollution Prevention Plans for Construction Activities, 28 February 1997**Description**

This EP provides guidance for the preparation and development of plans for preventing storm water pollution at construction sites. Such SWPPPs are responsive to the requirements of Section 402 of the Clean Water Act. This EP includes Section 3 on site description, Section 4 on source identification, Section 5 on storm water management controls, and Section 6 on mobilization, implementation, monitoring, and documentation.

Are incremental changes (ICs) mentioned?

No direct referrals to ICs are included in EP 1110-1-16; however, the influence of site planning, best management practices for erosion and sediment control, and source control and delivery reduction measures are addressed. ICs could influence these considerations.

Why should ICs be addressed?

ICs could influence several features of SWPPPs; however, at this time no necessary changes in EP 1110-1-16 are foreseen.

Recommendation

No additions of information on ICs are needed at this time. However, as further work on the IC project is completed, it would be appropriate to reconsider potential changes in EP 1110-1-16. (This is a Level 0 Recommendation at this time.)

EC 1110-2-6065, Guidance for a Comprehensive Evaluation of Vertical Datums on Flood Control, Shore Protection, Hurricane Protection, and Navigation Projects, 1 July 2007**Description**

This EC provides guidance on the proper application of vertical datums used to reference protection elevations on flood control structures or excavated depths in navigation projects in coastal/tidal regions and on inland flood protection and navigation projects. Frequent reference is made to Hurricane Katrina and the variable vertical datums in the New Orleans area. Further, emphasis is given to establishing appropriate vertical datums for inland projects (Appendix A) and coastal projects (Appendix B).

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied throughout EC 1110-2-6065 as causative factors in problems related to vertical datums.

Why should ICs be addressed?

Examples of ICs other than those associated with Hurricane Katrina could be added to EC 1110-2-6065. Such examples could be used to support the recognition that multiple causative factors can contribute to inconsistencies in vertical datums in local areas.

Recommendation

The term IC should be defined, added, and explained at appropriate places within ER 1110-2-6065 (Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL clarifying and explaining ICs in relation to the contents of ER 1110-2-6065).

EC 1105-2-410, *Review of Decision Documents*, 22 August 2008**Description**

This EC applies to all feasibility studies, re-evaluation studies, and reports associated with modification of projects that include EISs and any other project studies that lead to decision documents. The importance of external peer review in improving USACE plans, projects, and programs is recognized in this EC. Key sections are related to policy (Section 6), types of review (Section 7), and the conduct of such external reviews (Section 8).

Are incremental changes (ICs) mentioned?

ICs are neither mentioned nor implied in EC 1105-2-410.

Why should ICs be addressed?

Because of the broad nature of EC 1105-2-410 and the diverse reports subject to such reviews, there is no specific need to address ICs.

Recommendation

EC 1105-2-410 does not need to be changed relative to the incorporation of ICs (Level 0 Recommendation).

Appendix C: Recommendations on Four Engineer Manuals that are Cross-Cutting Relative to Water Quantity and Quality Management for the Three Mission Areas

EM 1110-2-1201, Reservoir Water Quality Analysis, 30 June 1987

Description

This EM provides a framework to guide USACE scientists and engineers in assessing water quality conditions associated with reservoirs, including the reservoir pool, water releases, and tailwaters. Specific topics within this 191-page manual are based on both research studies and professional experience. Practical chapters are included on selection of water quality parameters (Ch. 2), planning for an assessment study (Ch. 3), assessment techniques (Ch. 4), and water quality data collection and analysis (Ch. 5).

Are incremental changes (ICs) mentioned?

No direct referrals to ICs are included; however, indirect references are incorporated in numerous places throughout the document.

Why should ICs be addressed?

ICs should be addressed if EM 1110-2-1201 is modified to include the assessment of influencing factors on the actual water quality within reservoirs.

Recommendation

Rather than modifying EM 1110-2-1201, it is recommended that a new document be developed that specifically focuses on monitoring the influences of ICs on reservoir water quality (Level 3 Recommendation: prepare a new EM or a new EP or ETL to support the existing EM 1110-2-1201).

EM 1110-2-3600, *Management of Water Control Systems*, 30 November 1987**Description**

This EM addresses project management related to the hydraulic and hydrologic aspects of completed projects; these considerations are incorporated in water control management activities. Such activities include data collection and handling, determination of project inflow, scheduling of releases, coordination of water management decisions, and determination of releases to meet water control objectives. This EM includes a compendium of elements related to the management of water control systems, including discussions of data collection and processing; water control analysis techniques; real-time management and systems analysis; and water quality, environmental, and associated aspects of water management.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied in many places throughout this 226-page document.

Why should ICs be addressed?

ICs can cause alterations in parameters that prompt decision-making relative to the management of water control systems. For example, changes in land use can cause changes in project inflows and releases.

Recommendation

Rather than modifying EM 1110-2-3600, it is recommended that a new document be developed that specifically focuses on monitoring ICs that can influence the management of water control systems (Level 3 Recommendation: prepare a new EM or a new EP or ETL to support the existing EM 1110-2-3600).

EM 1110-2-4000, *Sedimentation Investigations of Rivers and Reservoirs*, 15 December 1989, Change Number 1, 31 October 1995**Description**

This EM provides guidance and engineering procedures for both river and reservoir sedimentation investigations. The subjects covered are pertinent for the planning, design, construction, and operation of flood control projects and navigation projects. Chapter 2 relates to the formulation and

planning of sediment studies, while Chapter 3 addresses sediment yield. Sediment yield can be influenced by ICs in land uses in the watershed. River sedimentation and reservoir sedimentation are highlighted in Chapters 4 and 5, respectively. Change No. 1 to EM 1110-2-4000 introduced four new chapters: Chapter 7 on Sediment Properties, Chapter 8 on Sediment Measurement Techniques, Chapter 9 on Sediment Transport Mechanics, and Chapter 10 on Non-equilibrium Transport.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied in numerous locations in this 177-page EM.

Why should ICs be addressed?

ICs should be addressed if EM 1110-2-4000 is modified to give more attention to the assessment of influencing factors on sediment yield and sedimentation in rivers and reservoirs with flood control and/or navigation projects.

Recommendation

Rather than modifying EM 1110-2-4000, it is recommended that a new document be developed that specifically focuses on monitoring the influences of ICs on sediment yield and sedimentation (Level 3 Recommendation: prepare a new EM or a new EP or ETL to support the existing EM 1110-2-4000).

EM 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans, 1 February 2001

Description

This 377-page EM provides guidance for the preparation of project-specific sampling and analysis plans (SAPs) for collecting environmental data. The goal is to promote consistency in generating and executing sampling and analysis plans and thus to help generate chemical data of known quality for its intended purpose. The EM includes four chapters (Introduction; Utilization of the EM; SAP – Format and Contents; and Sampling and Analysis Protocols). Further, 10 appendices focus on specific issues ranging from sample collection and preservation to analytical techniques and QA/QC procedures.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned or implied in EM 200-1-3.

Why should ICs be addressed?

Because of the SAP focus of this EM, there is no specific reason for adding ICs to this EM.

Recommendation

No IC-related changes are recommended for EM 200-1-3 (Level 0 Recommendation).

Appendix D: Recommendations on Seven Regulations and Related Documents that are Cross-Cutting Relative to Responses to Incremental Changes

ER 1165-2-119, *Modifications to Completed Projects*, 20 September 1982

Description

This ER addresses planning and authorization requirements for modifications to existing projects. Examples of modifications include changes in project operation, changes in real estate interests, physical changes of a project feature, the addition of project features, or changes in the purposes of a project. These modifications typically result from ICs in watershed land use, laws or regulations, design re-evaluations, and public demands for increased project purposes. Specific project deficiencies as discovered through studies and monitoring may also prompt needed modifications; such deficiencies could be ascertained from changes in design factors and practices. This ER also addresses modifications under both existing and continuing authorities, as well as modifications requiring Congressional authorization.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned; however, they are implied throughout this ER, providing numerous, albeit brief, examples of ICs that could require modification to completed projects.

Why should ICs be addressed?

Modifications of completed projects typically occur from ICs resulting from policy changes, societal desires, and/or watershed land use changes and associated changes in water supplies.

Recommendation

The term IC should be defined, added, and explained at appropriate places within this ER. Further, examples of specific ICs should also be added, as appropriate, throughout the ER. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, through-

out the document, or the issuance of an EP or ETL clarifying and explaining ICs in relation to the contents of ER 1165-2-119.) The Adaptive Management PDT also targeted this ER for potential changes.

ER 1110-2-100, Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures, 15 February 1995

Description

This ER relates to periodic inspections and evaluations of Civil Works structures whose failure or partial failure could jeopardize the operational integrity of the project, endanger the lives and safety of the public, or cause substantial property damage. Details related to USACE responsibilities for both USACE and non-USACE projects and their operations are addressed, including the frequency of inspections for dams and appurtenant structures, navigation structures, levees, flood walls, etc. Information is also included on the necessary contents of inspection reports.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, although they are implied throughout this ER. In fact, periodic inspections and evaluations of structures can be prompted by several types of ICs.

Why should ICs be addressed?

ICs could be used to denote causative factors leading to the need for inspections and evaluations. The results from such evaluations could lead to modifications to completed projects (ER 1165-2-119).

Recommendation

The term IC should be defined, added, and explained at appropriate places within this ER. Further, examples of specific ICs should also be added, as appropriate, throughout the ER. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an EP or ETL clarifying and explaining ICs in relation to the contents of ER 1110-2-100.)

**ER 1110-2-240, *Water Quality Management*, 8 October 1982;
Change 1, 30 April 1987; and Change 2, 1 March 1994**

Description

This ER focuses on the establishment of water control plans for USACE and non-USACE projects. Such plans exist or will be developed for reservoir regulation schedules, locks and dams, re-regulation and major control structures, and interrelated systems. Water control plans are to be clearly documented in appropriate water control manuals. These plans and manuals should be developed or modified in concert with all basin interests. Periodic reporting of monitoring programs and their results are also noted.

Are incremental changes (ICs) mentioned?

The term ICs is not used, but several inferences to changes are included in this ER.

Why should ICs be addressed?

Anticipated ICs could influence the contents of new plans or manuals, or modifications to existing ones. For example, ICs could influence reporting frequencies and the specific contents of monitoring programs.

Recommendation

The term IC should be defined, added, and explained at appropriate places within this ER. Further, examples of specific ICs should also be added, as appropriate, throughout the ER. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an EP or ETL clarifying and explaining ICs in relation to the contents of ER 1110-2-240.) This ER is related to EM 1110-2-3600 (Management of Water Control Systems).

ER 1110-2-401, *Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual for Projects and Separable Elements Managed by Project Sponsors*, 30 September 1994

Description

This ER provides instructions for the USACE's preparation of OMRR&R Manuals outlining the responsibilities of local sponsors that have a separate project cooperation agreement (PCA) that requires them to pay 100 percent of these costs. Sections in the OMRR&R Manuals prepared by the

USACE should address general information, authorization, project location, pertinent project information, construction history, project performance, PCA, operation, emergency operations, maintenance and inspection, surveillance, repair, replacement and rehabilitation, and notification of distress.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned; however, they are implied in certain sections.

Why should ICs be addressed?

ICs could influence the frequencies of inspections and resultant repairs, replacements, and rehabilitations.

Recommendation

No changes are needed in this ER at this time (Level 0 Recommendation). However, following completion of additional work on this IC project, potential changes to this ER should be reconsidered.

ER 1110-2-8154, Water Quality and Environmental Management for Corps Civil Works Projects, 31 May 1995

Description

This ER established policies for ongoing water quality management at Civil Works projects. Such management encompasses the improvement, restoration, conservation, and protection of the physical, chemical, and biological quality of the water for natural and human uses. Collaboration with interested stakeholders is also encouraged, along with the recognition that water quality can be influenced by multiple dynamic factors. Frequent references are made to water control plans (ER 1110-2-240). In addition to routine monitoring and annual reports for projects, three other post-project (after a project is in operation) reports are noted. They include “project-specific reports” to address pertinent factors (e.g., ICs) affecting water quality; “special situation reports” related to unique events such as spills; and “special study reports” that address issues of concern (e.g., ICs) in an in-depth manner. Further, “needs assessment reports” (pre-project) could be used to describe historical and potential future ICs and incorporate them in project planning.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned; however, brief examples of ICs are included throughout this ER.

Why should ICs be addressed?

ICs can be primary causative factors that can influence water quality and its management at USACE Civil Works projects.

Recommendation

This ER should be reorganized so that ICs and their influence on water quality management become a central feature. (This is a Level 2 Recommendation: the ER could be reorganized or a corollary EC or EP could be produced that addresses the dynamic influence of ICs on water quality. Further, the addition of IC considerations in the above types of reports could also be specified in a related EC or EP.)

ER 1105-2-100, *Continuing Authorities Program*, Appendix F, Amendment No. 2, 31 January 2007**Description**

Appendix F contains the policy and procedural guidance for planning, designing, and implementing projects pursued under the legislative and administrative provisions of the Continuing Authorities Program (CAP). The CAP includes 10 legislative authorities that enable the USACE to plan, design, and implement certain types of projects without seeking additional project-specific Congressional authorization. The authorities include (1) Section 14, Flood Control Act of 1946, as amended (streambank and shoreline erosion protection of public works and non-profit public services); (2) Section 103, River and Harbor Act of 1962, as amended (amends Public Law 79-727) (beach erosion and hurricane and storm damage reduction); (3) Section 107, River and Harbor Act of 1960, as amended (navigation improvements); (4) Section 111, River and Harbor Act of 1968, as amended (shore damage prevention or mitigation caused by Federal navigation projects); (5) Section 145, Water Resources Development Act of 1976, as amended (placement of dredged material on beaches); (6) Section 204, Water Resources Development Act of 1992, as amended (beneficial uses of dredged material); (7) Section 205, Flood Control Act of 1948, as amended (flood control); (8) Section 206, Water Resources Development Act of 1996, as amended (aquatic ecosystem restoration); (9) Section 208, Flood Control Act of 1954, as amended (amends Section 2, Flood Control Act of

28 August 1937) (removal of obstructions, clearing channels for flood control); and (10) Section 1135, Water Resources Development Act of 1986, as amended (project modifications for improvement of the environment). Further, Section III of this Appendix includes specific guidance for projects related to the above-listed 10 authorities.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned in Appendix F. However, they are implied in Section F-22 (design deficiency corrections).

Why should ICs be addressed?

ICs do not need to be addressed in Appendix F at this time.

Recommendation

No changes are needed in Appendix F at this time (Level 0 Recommendation). However, following completion of further work on this IC Project, it may be appropriate to reconsider if changes are needed in Appendix F.

EC 1165-2-208, In-Kind Contribution Provisions of Section 221, 6 June 2008

Description

This EC provides guidance on the in-kind contribution provisions of Section 221 of the Flood Control Act of 1970 as amended by Section 2003 of the Water Resources Development Act of 2007. These provisions provide a general authority to afford credit toward the non-Federal share of the costs of a project, or separable element of a project, for the value of in-kind contributions provided or performed before or after execution of the applicable cost-sharing agreement. These in-kind contribution provisions are applicable to water resources projects authorized after 16 November 1986, without specific authorization in law if the Project Partnership Agreement (PPA – formerly known as a Project Cooperation Agreement or PCA) is executed after 8 November 2007, the date of enactment of WRDA 2007. For the purposes of this EC, projects initiated without specific authorization in law include the Continuing Authorities Program (CAP) authorities and regional authorities that do not require any additional authorization to implement a project (e.g., Section 542 of WRDA 2000 and Section 544 of WRDA 2000) but do not include the environmental infrastructure programs or projects.

Are incremental changes (ICs) mentioned?

No ICs are directly mentioned or implied.

Why should ICs be addressed?

Because of the focus of this EC, information on ICs would not be relevant.

Recommendation

No IC-related changes are necessary for EC 1165-2-208 (Level 0 Recommendation).

Appendix E: Excerpts on the History of Inland Navigation (EP 870-1-45, U.S. Army Corps of Engineers, 1 January 1988)

The following excerpts from EP 870-1-45 (The History of the U.S. Army Corps of Engineers, 1 January 1988) illustrate a few of the significant past incremental changes in the inland navigation mission of the USACE.

Although its work on fortifications was important, perhaps the greatest legacy the early Corps of Engineers bestowed to future generations was its work on canals, rivers, and roads. America was a young nation, and rivers were its paths of commerce. They provided routes from western farms to eastern markets and for settlers seeking new homes beyond the Appalachian frontier. The rivers beckoned and enticed, but then could treacherously destroy the dreams of unwary travelers and shippers whose boats were punctured by snags and sawyers or stranded by sandbars. Both commercial development and national defense, as shown during the War of 1812, required more reliable transportation arteries. Out of those unruly streams, engineers carved navigation passages and harbors for a growing nation.

In 1824, the Supreme Court ruled in *Gibbons v. Ogden* that Federal authority covered interstate commerce including riverine navigation. Shortly thereafter, Congress passed two important laws that, together, marked the beginning of the Corps' continuous involvement in Civil Works. The General Survey Act authorized the president to have surveys made of routes for roads and canals "of national importance, in a commercial or military point of view, or necessary for the transportation of public mail." The president assigned responsibility for the surveys to the Corps of Engineers. The second act, passed a month later, appropriated \$75,000 to improve navigation on the Ohio and Mississippi rivers by removing sandbars, snags, and other obstacles. Subsequently, the act was amended to include other rivers such as the Missouri. This work, too, was given to the Corps of Engineers—the only formally trained body of engineers in the new republic and, as part of the nation's small army, available to serve the wishes of Congress and the executive branch.

Congress expanded the Army engineers' workload in 1826. New legislation authorized the president to have river surveys made to clean out and deepen selected waterways and to make various other river and harbor improvements. Although the 1824 act to improve the Mississippi and Ohio rivers is often called the first rivers and harbors legislation, the 1826 act was the first to combine authorizations for both surveys and projects, thereby establishing a pattern that continues to the present day.

An early project that reflected engineer innovation was the removal of sandbars in the Ohio River. By September 1825, topographical engineer Major Stephen H. Long, working on the Ohio River just below Henderson, Kentucky, had constructed a wing dam consisting of two rows of more than 600 wooden piles, driven to a depth of 16 feet. He experimented with the proper angle, width, and length to achieve the greatest velocity of current. Theory and empirical data agreed that the increased velocity should reduce the sandbar and increase the height of the river. Long finally figured out an angle and length for the dam that seemed to work, and the dam served as the prototype for many others along the Ohio River. It required no significant repair until 1872.

Henry M. Shreve constructed a revolutionary new steam-powered snag boat that was put into service in 1829. It became the model for steam snag boats on the Ohio, Mississippi, and elsewhere. Shreve's boat ran full steam into the snags, jarring them loose. The limbs were then hoisted and broken apart on the vessel's deck. "Uncle Sam's tooth pullers," Shreve's snag boats came to be called. They were unlike anything known elsewhere in the world, and their impact was dramatic. Insurance and shipping rates dropped, and the number of steamboats on the Mississippi and Ohio rivers increased significantly.

The innovative work to clear the nation's rivers of navigation obstacles continued after the Civil War. In 1871, engineer Major Quincy A. Gillmore chartered a steamer and converted it for suction dredging. Named the *Henry Burden*, the converted boat was the Corps' first hydraulic dredge, and one of the first in the country. Within 3 years, the government purchased another propeller-driven steamer, the *Woodbury*, and converted it into a suction dredge to deepen the Cape Fear River below Wilmington, North Carolina. More than half a dozen hydraulic hopper dredges were constructed for the Corps just before the turn of the century.

After the Civil War, a special Army Engineer Board concluded that a system of locks and dams on the Ohio River was preferable either to continued dependence on wing dams and dredging or to the construction of a system of canals to bypass the Ohio's obstacles. Major William E. Merrill, who was in charge of Ohio River improvements, needed to develop a system of river regulation dams that would easily allow passage of coal barges. He concluded that the wicket dam design developed by Jacques Chanoine in France in 1852 would be best, and in 1874 he formally proposed that a series of movable dams, employing Chanoine wickets, be constructed on the Ohio. After Congress approved Merrill's plan in 1877, the Corps began constructing the Davis Island project, just south of Pittsburgh. Completed in 7 years, the 110 by 600-foot lock and 1,223-foot dam were the largest in the world at that time. The Davis Island Lock also was one of the first in the country to use concrete in place of stone masonry. The Corps' success at Davis Island led Congress to authorize extension of the project down the Ohio. Later, the Corps increased the initial 6-foot channel to 9 feet. The project was completed in 1929 at a cost of about \$125 million.

Throughout the 19th century, engineer officers were involved in the construction, maintenance, and rehabilitation of canals and river navigation features. They surveyed the Chesapeake and Ohio and the Muscle Shoals canal routes in the 1820s. Several prominent Army engineers launched their careers at the revived Muscle Shoals after the Civil War. These included Major William Rice King and Lieutenants William Louis Marshall, later chief of engineers, and George W. Goethals. Goethals designed the Riverton Lock with a low-water lift of 26 feet, the largest yet attempted in the United States when the Muscle Shoals Canal opened in 1911. Successes like these assured that engineers like Goethals would be called on again, as he was for the Panama Canal.

The Corps' canal-building efforts continued in the 20th century. After the Federal government purchased the Chesapeake and Delaware Canal in 1919, the Corps' Wilmington (Delaware) District directed a reconstruction effort to deepen the channel to 12 feet and add several bridges. Traffic soon increased, and as an immediate result, demands were made to enlarge it. The C&D Ship Canal became part of an intercoastal waterway envisioned to connect existing bodies of water in a line roughly paralleling the coast from Boston, south to Key West, and then west to the Rio Grande. Today, the Corps retains responsibility for this canal and the entire intracoastal waterway of which it is a part.

In the 1910 Rivers and Harbors Act, Congress authorized the construction of a nine-foot Ohio River canalization project. At a cost of about \$125 million, the project was completed in 1929. Meanwhile, the Corps had been busy in other parts of the country developing a reliable internal waterway system. One of the key projects, going back to the mid-19th century, was the Soo Locks at Sault St. Marie, Michigan. These locks were instrumental in securing a navigable route from the copper and iron mines on the shores of Lake Superior to the industrial plants of the East. The Army's success in providing a passage to Lake Superior and Canada's commitment to canal building whetted the desires of shippers and industrialists for a deep water route through the Great Lakes—a dream eventually realized in the 20th century with the completion of the St. Lawrence Seaway.

It was the turn of the century when Congress responded to the renewed interest in water transportation by authorizing navigation projects designed to create an integrated system connecting inland areas with coastal harbors. Sandbars and rapids along the Ohio, Missouri, Arkansas and other major rivers posed major obstacles to the maintenance of year-round navigation channels. Eventually, with the advancement of lock and dam technology and more efficient dredging equipment, a nine-foot channel depth was assured in the Mississippi and its major tributaries.

Commercial use of the 12,000 miles of inland and intercoastal waterways has increased: approximately one-sixth of all intercity cargo is transported by water. Waterborne commerce, recognized by experts to be the least expensive and least energy consumptive means of transportation, is the logical choice for shippers of energy-producing commodities. Petroleum and coal together comprise more than half of all waterborne freight on the Federally maintained waterways. This expansion has been facilitated by the Corps' work on major waterways, including locks and dams. The Corps dredges more than 300 million cu yd of material annually to maintain authorized channel depths and constructs bank stabilization projects in its traditional role as the primary developer of the nation's waterways.

As of 1996, engineer districts and divisions owned or operated 275 lock chambers at 230 sites. The oldest operating locks are Locks 1 and 2, which were built on the Kentucky River in 1839. The nation's newest locks opened in December 1994 and included the Joe D. Waggoner Lock and the Russell B. Long Lock on the Red River. An efficient system of interconnected waterways has proven to be a key factor in America's ability to mobilize in the event of war.

Appendix F: Recommendations on Seven Regulations and Related Documents that Address Inland Navigation Projects

EP 1130-2-520, Navigation and Dredging Operations and Maintenance Guidance and Procedures, 29 November 1996

Description

This pamphlet establishes the guidance for navigation and dredging operation and maintenance (O&M) activities of the USACE and supplements Engineer Regulation (ER) 1130-2-520.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, acknowledgment of change is evidenced by the following provisions:

- **Emergency Dredging.** Dredging performed in response to unexpected situations requiring an immediate action to protect property or human life or to maintain or restore navigation or flood control channels to provide for safe and efficient usage of the waterways, within the 48 contiguous States, Alaska, Hawaii, Puerto Rico, the Virgin Islands, or U. S. Trust Territories.
- **Section 2-6.a.** Changes affecting navigation will be made promptly whenever information of immediate concern to navigation becomes known.
- **Section 2-6.d.(1)(h).** Update information on method of publishing changes.
- **Section 2-6.h.** Corrections/Revisions. Significant changes or corrections to a chart will be published by means of a Notice to Navigation Interests. The notice will provide sufficient detail to permit the chart users to correct the chart or will provide an overlay for correction of the affected area on the chart.
- **Section 4-3.a.** Over the years, several significant court cases have circumscribed the scope of the law by defining “navigable channel,” “abandonment,” the owner’s duty to mark/remove, the USACE’s duty to protect navigation, and legal liability generally. The U.S. Code (Annotated) provides citations and summaries of several key cases for further reference. The agency’s nationwide policies take the overall case history

into consideration but are not bound by the results of every individual case.

- Section 4-3.d. One of the levers for effective enforcement is the ability to remove the wreck under Federal authority and then recover costs from the responsible party. In the past, the USACE's ability to enforce removal by the owner was seriously constrained by the requirement to prove negligence (in the sinking) and, sometimes, by difficulty in tracing a financially viable owner. The Water Resources Development Act of 1986 (PL 99-662) eliminated the prerequisite of negligence and extended financial liability to vessel operators and lessees for wrecks occurring after 17 November 1986.
- Section 5-5.d(5) Harbor Maintenance Tax information is required for cargo movements into or out of ports that are subject to the provisions of Section 1402 of the Water Resources Development Act of 1986 (PL 99-662).
- Section 5-10. Approval required to add, modify, or delete tables from the *Waterborne Commerce of the United States* (<http://www.iwr.usace.army.mil/ndc/data/datawcus.htm>).

Why should ICs be addressed?

Although many dredging activities are relatively routine and predictable in nature, there are also conditions and events that cannot be anticipated. Provisions for dealing with the unpredictable are necessary to maintaining the Nation's waterways in a safe and reliable manner.

Recommendation

Level 0 (no change needed). When this pamphlet is next updated, the term IC should be defined and added. ICs should be explained in appropriate places within the pamphlet.

ER 1110-2-1457, Engineering and Design Hydraulic Design of Small Boat Navigation Projects, 24 June 1985

Description

This regulation prescribes the design procedure and rationale for the development of small boat navigation projects.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied in several places. Examples:

- “The hydraulic design study plan must be flexible and able to adjust to changes in the project development and other circumstances. The effects of uncertainty should be demonstrated by sensitivity analysis procedures when significant design elements are involved.”
- “Shoreline Changes. The natural growth or recession of the shoreline and offshore hydrography is needed to predict project impacts. If the project creates adverse impacts such as accretion or erosion, suitable mitigation measures are needed. Some of these measures can be sand bypassing or beach protection structures. (EM 1110-2-1615).”
- “When dredging is required, a study is needed to identify the dredging and disposal method and short- and long-term disposal effects. Beneficial uses of dredge material need to be evaluated.”
- “Rehabilitation and replacement options are to be evaluated when normal maintenance becomes excessive or when the project stops functioning properly. Rehabilitation design will incorporate features that would be included in a modern project.”

Why should ICs be addressed?

The possibility of ICs is recognized for unanticipated conditions and performance of small boat navigation projects. These may be the result of changed conditions, uncertainty, and/or future project requirements. The addition of a specific section on ICs would more clearly communicate the need to recognize and deal with future changes in requirements and/or conditions.

Recommendation

The term IC should be defined, added, and explained in an appropriate place within the regulation. Mechanisms for accommodating ICs should also be added in the same section. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL clarifying and explaining ICs in relation to the contents of ER 1110-2-1457.)

ER 1110-2-1458, Hydraulic Design of Shallow Draft Navigation Projects, 30 April 1998

Description

This regulation prescribes the policy and design procedures for development of a new or replacement of an existing shallow draft navigation project. “Shallow draft” refers to commercial barge traffic.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied in several places. Examples:

- “The hydraulic design study plan must be flexible and able to adjust to changes in the project development and other circumstances.”
- “The effects of uncertainty should be demonstrated by risk analysis procedures for the significant design elements involved.”
- “Rehabilitation design will consider all features that would be included in a modern project.”
- “The design of shallow draft navigation projects requires an understanding of the problem, assembly and evaluation of all pertinent facts, and the development of a rational plan with identified risks and uncertainties.”

Why should ICs be addressed?

The possibility of ICs is recognized for unanticipated conditions and performance of shallow draft navigation projects. These may be the result of changed conditions, uncertainty, and/or future project requirements. The acknowledgment of unanticipated factors and additional future needs is sufficient as written.

Recommendation

Level 0 (no change needed). When this regulation is next updated, the term IC should be defined, added, and explained in an appropriate place within the regulation. Mechanisms for accommodating ICs should also be added in the same section.

ER 1130-2-520, Navigation and Dredging Operations and Maintenance Policies, 29 November 1996**Description**

This regulation establishes the policy for the operations and maintenance (O&M) of USACE navigation and dredging projects, as well as their related structures and equipment.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. Evidence of ICs is included by the following: “This regulation supersedes Engineer Regulations (ER) 15-2-6, dated 1 December 1990; 325-2-2, dated 1 November 1993; 670-2-2, dated 19

March 1987; 670-2-3, dated 20 April 1987; 1130-2-306, dated 8 May 1978; 1130-2-307, dated 31 October 1968; 1130-2-310, dated 15 July 1969; 1130-2-315, dated 15 January 1991; 1130-2-316, dated 15 January 1991; 1130-2-317, dated 10 May 1989; 1130-2-429, dated 1 January 1991; 1130-2-439, dated 22 December 1987; 1130-2-340, dated 15 August 1983; 1130-2-341, dated 1 February 1991; 1145-2-301, dated 1 July 1968; 1145-2-305, dated 1 June 1988; and 1145-2-308, 15 June 1992.” ICs are also implied in several places. Examples:

- Changes or corrections to a chart (e.g., new bridges or other structures extending over or into the waterway, new obstructions to navigation, change in the course of a river, change in permanent aids to navigation, etc.) shall be published by means of a Notice to Navigation Interests (NTNI).
- Proposed changes to the area serving as the basis for each statistical table contained in the annual regional publications shall be submitted for prior approval to the Director, NDC, through the appropriate District and MSC commanders, together with a statement of justification, unless the change is prescribed by a River and Harbor Act.
- Section 933 of WRDA of 1986, as amended by Section 35 of WRDA of 1988, and Section 207 of WRDA of 1992 provides authority for the Secretary of the Army, if requested by a state, to place beach quality sand dredged in constructing or maintaining navigation improvements on adjacent beaches if the work is deemed to be in the public interest and upon payment by such state of fifty percent of the increased cost.
- Section 204, Water Resources Development Act of 1992 (PL 102-580) authorizes the Secretary of the Army to carry out projects for the protection, restoration, and creation of aquatic and ecologically related habitats, including wetlands, in connection with dredging for construction, operation, or maintenance of an authorized Federal navigation project.

Why should ICs be addressed?

The possibility of ICs is recognized for changed navigation conditions and added authorities pertaining to dredging and disposal of dredged material. The recognition of unanticipated factors and new authorities is sufficient as written.

Recommendation

Level 0 (no change needed). When this regulation is next updated, the term IC should be defined, added, and explained in an appropriate place within the regulation. Mechanisms for accommodating ICs should also be added in the same section.

ER 1165-2-27, Establishment of Wetland Areas in Connection with Dredging, 18 August 1989**Description**

This regulation provides guidance for establishing wetland areas in connection with dredging required as part of water resources development projects.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. Evidence of ICs is included by the following:

- Section 150 of PL 94-587 (WRDA 1976) authorizes the Chief of Engineers to plan and establish wetland areas as part of water resources development projects.
- “This regulation supersedes ER 1165-2-27, 30 July 1982.”
- For operating projects, authorized projects, including those under construction, and continuing authority projects, project costs may be increased up to \$500,000 per wetland area proposed.
- Division commanders will advise HQUSACE (CECW-O) of the initiation of any Operation and Maintenance (O and M) studies relative to the establishment of wetland areas in connection with completed portions of any authorized water resource project.

Why should ICs be addressed?

The authority is established for dredging projects in any phase of a project life cycle. The addition of ecosystem benefits associated with dredging and the ensuing regulation providing for implementation is sufficient as written.

Recommendation

Level 0 (no change needed). When this regulation is next updated, the term IC should be defined, added, and explained in an appropriate place within the regulation. Mechanisms for accomplishing ICs are appropriate,

and inclusion of monitoring and adaptive management should be incorporated in the update.

ER 1165-2-122, Studies of Harbor or Inland Harbor Projects by Non-Federal Interests, 26 August 1991

Description

This regulation provides policy guidance for implementing Section 203 of the Water Resources Development Act of 1986, Public Law (PL) 99-662, which authorizes non-Federal interests to undertake, on their own, a feasibility study of a proposed harbor or inland harbor project.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, the entire regulation implementing Section 203 of WRDA 1986 represents an IC to USACE authorities and cost-sharing provisions.

Why should ICs be addressed?

The authority is established for the USACE to accept a non-Federal study report in lieu of a USACE feasibility study report. An unusual aspect of this authority is the provision that, once accepted by the USACE, the study report may be used by Congress to authorize a USACE project.

Recommendation

Level 0 (no change needed). When this regulation is next updated, the term IC should be defined, added, and explained in an appropriate place within the regulation.

Appendix G: Recommendations on Seven Engineer Manuals that Address Inland Navigation Projects

EM 1110-2-1604, Hydraulic Design of Navigation Locks, 1 May 2006

Description

This manual presents the results of research, design studies, and operation experience as guidance for the hydraulic design of navigation locks.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, acknowledgment of change is evidenced by the following provisions:

- This manual supersedes EM 11 10-2- 1604, *Hydraulic Design of Navigation Locks*, 30 June 1995.
- Centers of expertise addressing environmental topics, hydropower, navigation, etc., may be located by query to HQUSACE.
- A list of most existing CE locks is in Appendix B. Plate 1-1 illustrates the historic trend away from certain designs (i.e., loop culverts and valves-in-gates) reflecting economic or operational liabilities. Substantial experience with sector gate (very-low-lift) and side-port (low-lift) designs is evident. One each of the longitudinal manifold (vertically divided flow by means of horizontal splitters) designs suggested for high-lift projects is in operation. An extensive summary of devices and concepts used in earlier (pre-1940) CE navigation locks and dams is available (item U1).
- Certain factors, such as number of chambers, when incremented are a major change in project concept and are not included in feature design. Other factors, such as operation time, may be varied by the design process to increase benefits but must be economically balanced with the increase in cost.
- Section 3-5. Recent Designs. Projects of each of the seven design types listed in Table 3-1 have recently been designed.
- Recent lock designs use reverse tainter valves for flow control. Alternate valve types provide less desirable hydraulic, structural, operational, or economic conditions. The normal tainter valve (skinplate upstream) has been replaced for lock design by the reverse tainter valve

- (skinplate downstream) because of the ease of regulating air demand for the latter design.
- Many existing locks have been designed without proper regard to efficient and smooth filling operations. However, modernization of obsolete projects introduces opportunities to design faster and more efficient system.
 - Section 7-19. Considerations for Rehabilitation and New Construction. Whenever lock rehabilitation or new construction is considered, a number of ice-related concepts should be evaluated.
 - Section B-9. Historical Development. A chart showing the historical change in design practice is included as Figure B-10.
 - Section I-1. Description. Lock extensions have been considered as a method to increase the capacity for existing navigation projects, especially those projects with a large main lock chamber and a smaller auxiliary chamber.

Why should ICs be addressed?

This EM represents the most up-to-date designs for navigation locks used by the USACE. As such, the manual must be updated as new design information or additional considerations affecting designs are known.

Recommendation

Level 0 (no change needed). When this manual is next updated, the term IC should be defined, and the important relationship of incremental changes to factors affecting modern lock designs should be discussed.

EM 1110-2-1605, Hydraulic Design of Navigation Dams, 12 May 1987

Description

This manual provides current guidance and engineering procedures for the hydraulic design of navigation dams.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, acknowledgment of change is evidenced by the following provisions:

- This manual supersedes EM 1110-2-2606, dated June 1952.
- Section 1-13. Environmental. Design of low-head navigation dams should consider measures to prevent environmental degradation, and enhancement where possible. Design should also facilitate operational

- procedures for environmental enhancement. Opportunities to add enhancing features should be considered during planning and design.
- The ever-increasing importance of environmental considerations requires that the designer maintain close liaison with many disciplines to be sure environmental and other objectives are satisfied in the design.
 - Section 2-3.d. Water Supply. Municipal water supply intakes are sometimes provided in dams built primarily for other purposes. Such problems as future water supply requirements and peak demands for a municipality or industry should be determined in cooperation with engineers representing local interests. Reliability of service and quality of water are of prime importance in water supply problems.
 - Section 2-8.c. Water Quality. An awareness of maintaining and/or enhancing the environment within the past decade has brought into existence a relatively new and expanded art of reservoir hydrodynamics. Until recently, the study of reservoir hydrodynamics has been limited to a few prototype vertical temperature gradients and recognition of the seasonal inversions accompanying the fall surface water cooling. However, environmental considerations of today have necessitated the development of pre-project capability for prediction of the expected seasonal reservoir stratification and circulation to permit construction and operation of navigation dams designed to meet storage and out-flow regimes needed for the reservoir and downstream environment.
 - Section 2-8.d. Environmental Impact Statements. Section 102(2)(c) of the National Environmental Policy Act (NEPA) requires detailed documentation in the project design memoranda on the impact of the planned project on the environment.
 - Section 3-15. Correlating the results of the sedimentation study with historical changes in the basin (channel improvements, land use, reservoirs, etc.) enables the engineer to develop a firm understanding of past and present sedimentation processes. With this information the effects of anticipated project features can be analyzed qualitatively.
 - It is imperative that the hydraulic engineer have an accurate estimate of what the tailwater curve will be before, during, and after project construction; and throughout the life of the project. The hydraulic engineer must evaluate the likelihood that the tailwater rating will change over this time period and evaluate the extremes to which this change may take place.
 - Section 8-3. Modernization Features. Modernization items should be considered in any rehabilitation plan. These items are intended to make the structure comparable to a state-of-the-art replacement. Mod-

ernization items will be evaluated based on faster operating time, safety, reliability, and reduced manpower needs.

Why should ICs be addressed?

This EM represents the most up-to-date designs for navigation dams used by the USACE. As such, the manual must be updated as new design information or additional considerations affecting designs are known.

Recommendation

Level 1. When this manual is next updated, the term IC should be defined, and the important relationship of incremental changes to factors affecting modern navigation dam designs should be discussed. Specifically, Section 3 should be revised to incorporate consideration of the projected effects of reasonably foreseeable future changes in the watershed on hydrological considerations discussed in the section.

EM 1110-2-2602, Planning and Design of Navigation Locks, 30 September 1995

Description

This manual is issued for guidance of engineers and design offices within the Corps of Engineers engaged in the planning, engineering layout, analysis, and design of navigation locks for Civil Works navigation projects on inland waterways.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, acknowledgment of change is evidenced by the following provisions:

- This manual supersedes EM 1110-2-2602, dated 30 June 1960.
- It has been found through experience that the planning and design process works most efficiently if these participating interests work through a multidisciplinary planning-engineering team effort.
- While the infrastructure is deteriorating, navigation traffic is increasing, thus creating a demand for larger, more efficient facilities.
- Section 2-2.b. Background. In the past, evaluations of existing structures have been based on deterministic analyses using current design criteria. Even with the adaptations permitted by ETL 1110-2-310, the current stability criteria are more stringent than criteria used in the design of many existing projects. Frequently, structures which have performed satisfactorily for years do not conform to current design crite-

- ria, indicating that current criteria alone should not be used to judge the reliability of existing structures.
- Section 2-2c. Criteria. Engineering criteria are needed for the purpose of evaluating existing projects, and they may differ from those used for designing new projects. The criteria should account for uncertainties in the investigations, testing, material properties, and analyses used in the rehabilitation decision process. Reliability assessments, based on probabilistic methods, provide more consistent results that reflect both the basis for design and the condition of the existing structure.
 - Section 2-2.d. Guidance. Guidance is provided in ETL 1110-2-321 and ETL 1110-2-532 for assessing the reliability of navigation structures and establishing an engineering basis for rehabilitation investment decisions. As these procedures mature and the associated methodology is developed, further guidance will be issued.
 - Section 3-1. General. In previous decades, many inland and coastal rivers and waterways were developed for navigation with channelization or navigation lock and dam projects. However, the emphasis in this era is on the modernization, addition, or replacement of the components of the existing inland waterway system for increased efficiency and/or major rehabilitation of deteriorating parts of this infrastructure.
 - The determination of commercial tonnage capacity required for a lock project is developed through economic studies of present and future commodity movement projections.
 - Section 3-5.a.(6) Innovative construction. Designers should study innovative construction methods which may reduce project costs. These innovations may include use of precast components, float-in elements, and in-the-wet construction to eliminate cofferdams.
 - Section 5-10.a.(1) Many improvements have been made in filling and emptying system designs in recent years, i.e., reduction of turbulence in the lock chamber and elimination of overfill and overempty situations by timely culvert valve operation. However, it is still necessary to use floating mooring bitts to keep barges and pleasure craft from drifting into the lock gates and bumping each other and to compensate for any human error in the filling and emptying process.
 - Section 7-3.b.it was several years before the best results were obtained with a single skin plate vertically framed body. Many shapes of the valve body, such as double skin plates with both plates convex, double skin plates with concentric skin plates, using both covered support arms and arms with no special treatment, were model tested and built before the single skin plate vertically framed layout was finally adopted as the best arrangement.

- Section 9-2.e. (1). Seismic coefficient method. Traditional design practice based on the seismic coefficient method failed to account for the dynamic response characteristics of the soil-structure water system. Locks designed by the seismic coefficient methods may not be adequately proportioned or reinforced to resist forces generated during a major earthquake. Therefore, this approach should be used only as a simple, preliminary means of checking a new design or an existing structure for seismic susceptibility. It should not be used as a final analysis procedure for controlling member proportions or for remedial design (with the exception of those cases where extensive results or comparisons of previously designed or evaluated structures are available).
- Section 10-2.a. The need for larger and stronger floating mooring bitts has been caused by the development of synthetic lines for checking and tying up the larger tows.
- Section 11-1. The objective for design of modern navigation projects is to provide navigation locks that are operationally and functionally reliable. Important design objectives are to minimize staffing requirements, improve operational efficiency, and decrease lock downtime for maintenance and replacement of operating components.
- Appendix D is a compilation of case histories of major incidents at several locks and dams. Of significance is the detailing of lessons learned from these incidents along with recommendations for changes in future designs, operations, procedures, training, communications, and preparedness.

Why should ICs be addressed?

This EM provides a compilation of detailed considerations and requirements to be incorporated into planning studies for navigation projects. As such, the manual requires periodic updating as new information or additional considerations affecting planning studies and recommendations are known. Appendix D is especially important in this regard, as it provides recommendations based on lessons learned from an actual major incident involving navigation projects.

Recommendation

Level 4: Establish a work group to study the concerns and develop the recommended solutions to identified problems beyond the scope of the ICP. In the course of this work group's efforts, the manual should be updated. The term IC should be defined, and the important relationship of incre-

mental changes to factors affecting modern navigation planning studies and recommendations should be discussed. Specifically, Appendix D should be revised as needed to continue developing and applying lessons learned from major incidents to future navigation planning considerations. For example, the loss of pool at Belleville L&D, as well as the incident at Montgomery L&D, should be incorporated.

EM 1110-2-2607, *Planning and Design of Navigation Dams*, 31 July 1995

Description

This manual is issued for guidance of individuals and elements within the USACE engaged in the structural planning, layout, and design of navigation dams for Civil Works projects. The structural design of gates is not covered in this manual.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, acknowledgment of change is evidenced by the following provisions:

- This manual rescinds EM 1110-2-2607, dated 1 July 1958.
- Section 2-7.f. Existing land ownership and usage. The consideration of real estate is not limited to the amounts and locations of that needed for the project and the associated costs but must also include the current land uses and the environmental and social issues associated with these uses. Some real estate usage is so sensitive that development of a project based on usage of such “sensitive” real estate would never come to fruition in today’s political and legal climates.
- Careful planning to maintain or enhance the environmental quality and mitigation measures may preclude or set aside the potential negative impacts that would render the project infeasible or not allow its approval. Also, high-quality resource management plans plus improved design and operation procedures will help maximize environmental benefits and help attain environmental quality objectives.
- Mathematical models, which are likely to be more economical than physical models, are being used to a greater extent as more accurate techniques are developed.
- Most waterways in the continental U.S. that have the potential for navigational usage are already developed. Thus, much of the future dam construction is likely to involve rehabilitation or replacement, and it will be done in a manner to facilitate use of portions of the existing na-

vigation features to the maximum extent practical and will likely involve innovative techniques.

- Section 2-12.d. Alternate methods of construction. The use of alternate methods to construct a navigation dam (other than within conventional cofferdams) may have significant advantages over conventional types of construction, in both initial construction costs and required construction time.
- Current access requirements involving the handicapped are referenced in an HQUSACE memorandum, *Uniform Federal Accessibility Standards* (UFAS), dated 3 November 1986. A redetermination of “current” access requirements should always be made in planning for new navigation dam construction.
- Section 4-3.b. Legal considerations. As the effects of navigation pools upon drainage do not involve direct invasion or overflow of lands, they have been defined by court decisions as “consequential damages,” which are not compensable in condemnation proceedings. However, damages of consequential nature have been reimbursed by special acts of Congress in several instances. In view of the precedents established by such legislation, probable damage to sewers and drainage should be evaluated as a cost of the project, and should be held to a practicable minimum.
- The National Environmental Policy Act (NEPA) of 1969 (PL 91-190) established a broad national policy directing Federal agencies to maintain and preserve environmental quality.
- Section 4-10 describes the invasion of zebra mussels into North America and the problems associated with infestations by these organisms. Also discussed are considerations for dealing with zebra mussels when planning navigation structures.
- Appendix C includes descriptions of three major accidents that are representative of what can occur (Markland in 1967 and Maxwell in 1985 and 1990).
- Past experience and model testing by WES have shown that bulkheads cannot be lowered safely one at a time in flowing water. Therefore, the stacked bulkhead system was developed so that the flowing water never goes over the top of the bulkheads.
- Traditional design practice based on the seismic coefficient method failed to account for the dynamic response characteristics of the soil-structure-water system. Dams designed by the seismic coefficient methods may not be adequately proportioned or reinforced to resist forces generated during a major earthquake.

- In planning surveillance systems, the designer should consult persons with experience and expertise in this technology, especially the latest state-of-the-art equipment available.
- B-2. a. General. The USACE operates in partnership with the Inland Waterways User Board (IWWUB), which shares the cost of designing and building navigation lock projects. Increased emphasis is being place on the key roles of the structural engineer (SE) and the project engineer (PE) in achieving high-quality products on schedule and within budget.
- Appendix C. Lessons Learned - Case Histories. C-1. General. This appendix will review some of the major and minor problems that have been experienced on navigation dam projects designed and built prior to 1993. Also, references will be given to USACE districts and divisions and other USACE organizations involved and to published material which relates to a specific problem and the follow-up action taken.

Why should ICs be addressed?

This EM provides a compilation of detailed considerations and requirements to be incorporated into planning studies for navigation dams. As such, the manual requires periodic updating as new information or additional considerations affecting planning studies and recommendations are known. Appendix C is especially important in this regard, as it provides recommendations based on lessons learned from an actual major incident involving navigation projects.

Recommendation

Level 4: Establish a work group to study the concerns and develop the recommended solutions to identified problems beyond the scope of the ICP. In the course of this work group's efforts, the manual should be updated. The term IC should be defined, and the important relationship of incremental changes to factors affecting modern navigation planning studies and recommendations should be discussed. Specifically, Appendix C should be revised as needed to continue developing and applying lessons learned from major incidents to future navigation planning considerations. For example, the loss of pool at Belleville L&D, as well as the incident at Montgomery L&D, should be incorporated.

EM 1110-2-5025, Dredging and Dredged Material Disposal, 25 March 1983**Description**

This manual provides an inventory of the dredging equipment and disposal techniques used in the U.S. and provides guidance for activities associated with new work and maintenance projects. This manual further provides guidance on the evaluation and selection of equipment and evaluation of disposal alternatives.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, acknowledgment of change is evidenced by the following provisions:

- For maintenance dredging of a recurring nature, samples will be taken before each dredging until the characteristics of the sediments are well known. For subsequent dredging, a small number of samples will be taken to identify and changes in sediment characteristics.
- Samples taken by conventional boring techniques are normally required for new work dredging.
- Much of the recent knowledge concerning dredged material disposal was gained as a result of the Dredged Material Research Program (DMRP) conducted by the U.S. Army Engineer Waterways Experiment Station (WES) and reported in WES Technical Reports. The major objectives of the DMRP were to provide definitive information on the environmental impact of dredging and dredged material disposal operations and to develop new or improved dredged material disposal practices.
- Thought must also be given to changing particular dredging techniques and disposal alternatives as conditions change.
- To minimize the turbidity generated by a clamshell operation, water-tight buckets have been developed. The edges seal when the bucket is closed and the top is covered to minimize loss of dredged material.
- In the most detailed study available on agitation dredging techniques, Richardson evaluated past agitation dredging projects and presented guidelines and recommendations for using agitation dredging.
- Section 3-13. Advances in Dredging Technology. Advanced dredging technologies are generally directed toward one or more of the following areas of improvement: greater depth capability; greater precision, accuracy, and control over the dredging process; higher production efficiency; and decreased environmental harm.

- Investigations which have been conducted by WES under the DMRP have studied the environmental effects caused by dredging and disposal operations. The results of these studies have been published as WES Technical Reports. Guidance on the environmental aspects of dredging and disposal is presented in Chapter 4.
- Section 4 discusses environmental issues, requirements, and considerations incrementally added over several years to dredging and disposal operations.
- There are now ample research results indicating that the traditional fears of water-quality degradation resulting from the resuspension of dredged material during dredging and disposal operations are for the most part unfounded.
- There are now cogent reasons for rejecting many of the conceptualized impacts of disposed dredged material based on classical bulk analysis determinations.
- In recent years, many active dredged material islands have been diked to improve the containment characteristics of the sites.
- Planned aquatic habitat development is a relatively new and rapidly moving field; however, with the exception of many unintentional occurrences and several small-scale demonstration projects, this alternative is largely untested. There are no general texts or manuals currently available; however, potential users may obtain updated information by contacting the Environmental Laboratory at the U. S. Army Engineer Waterways Experiment Station.

Why should ICs be addressed?

This EM provides detailed guidance on a variety of dredging and disposal methods in use by the USACE. Included are applications for new and/or beneficial uses of dredged material. Unfortunately, the EM is very old, and more recently developed and tested methods should be included in future updates.

Recommendation

Level 3: Prepare a new document that is specifically focused on ICs or issue an EC or revised EM incorporating the most recent information on dredging and disposal methods.

EM 1110-2-5026, Beneficial Uses of Dredged Material, 30 June 1987

Description

This manual provides guidance for planning, designing, developing, and managing dredged material for beneficial uses, incorporating ecological concepts and engineering designs with biological, economical, and social feasibility.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, acknowledgment of change is evidenced by the following provisions:

- Beneficial uses of dredged material have been proven on numerous sites in U.S. waterways. This manual will be helpful to USACE scientists and engineers responsible for dredging and dredged material disposal using environmentally, economically, and socially sound techniques and beneficial use management strategies.
- Recognition of the ecological value of many areas that have been historically used as dredged material disposal sites has resulted in severe environmental constraints on the location and placement of disposal sites, especially those in open water and wetlands. These constraints have increased the values placed on coastal and riparian wetlands and aquatic areas and have increasingly accented the need for alternate methods of dredged material disposal. As land uses have changed and areas once available for dredged material disposal have become scarce, the concept of beneficial use of dredged material disposal sites, such as land improvement and habitat development, have become more attractive economically and more environmentally acceptable.
- Section 1-4.a. Since enactment in 1969 of the National Environmental Policy Act (NEPA) with its requirement for environmental full disclosure (including, in this case, a detailed accounting of disposal alternatives), pressure for greater reliance on confined or on-land disposal of dredged material has increased significantly. At the same time, upland disposal sites are being rapidly depleted due to urbanization, agriculture, and utilization of available capacity in existing sites.
- In recent years, only in the special case of the Great Lakes where in-lake confined disposal facility (CDF) islands have been built, and in certain harbors where CDFs and islands were permitted, has land been created where an aquatic environment previously existed.

- Degrading water quality has caused greater emphasis to be placed on assessing hypothetical impacts of disposal operations in open waters and wetlands. These concerns have led to a profusion of legislation at the Federal, state, and local levels designed to control nearly every facet of the dredging and disposal operation.
- Although there are more than 30 Federal laws and Presidential Executive Orders (EOs) applicable to beneficial use activities, documentation or public coordination is only required when a beneficial use falls within the specific jurisdiction of a law or EO. The requirement to demonstrate compliance in some cases, such as in EO 11988, is little more than a sentence or two in the NEPA document. In other instances, such as the Clean Water Act of 1977 (CWA), extensive coordination and environmental evaluations may be required. Further, the environmental compliance process for private versus CE dredging and disposal is different.
- Through the provisions of the CWA and CZMA, states have the authority to regulate most beneficial use activities. State procedural requirements are independent of Federal compliance.

Why should ICs be addressed?

This EM provides detailed guidance on a variety of methods in use by the USACE to provide benefits in conjunction with dredging and disposal of dredged material. The sections incorporated above are just a few examples from the EM, but they point out how incremental changes have influenced planning for beneficial uses. Unfortunately, the EM is very old, and more recently developed and tested methods should be included in future updates.

Recommendation

Level 3: Prepare a new document that is specifically focused on ICs related to beneficial uses of dredged material or issue an EC or revised EM incorporating most recent information on dredging and disposal methods to achieve beneficial uses.

EM 1110-2-5027, Confined Disposal of Dredged Material, 30 September 1987

Description

This manual provides guidance for planning, designing, constructing, operating, and managing confined dredged material disposal areas to retain

suspended solids during disposal operations and to provide adequate storage volume for both short-term and long-term disposal needs.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned. However, acknowledgment of change is evidenced by the following provisions:

- This manual supplements EM 1110-2-5025 by providing detailed guidance for confined dredged material disposal.
- Many of the design procedures in this manual have been incorporated into the Automated Dredging and Disposal Alternatives Management System (ADDAMS), a centralized computer-program and data management system.
- The authority for implementing the planning, design, and operation and management approaches described in this manual is recognized in Section 148 of PL 94-587 (WRDA 1974): Sec. 148.
- Accuracy (of Storage Capacity-Time Relationship) can be greatly improved by updating the estimates every few years using data from newly collected samples and laboratory tests. Observed field behavior should also be routinely recorded and used to refine the projections.
- Riverine Utility Craft (RUC), an amphibious vehicle using twin screws for propulsion and flotation, was initially developed in the 1960s as a reconnaissance vehicle for military applications and was used on an experimental basis for trenching operations. RUC vehicles have since been successfully applied in dewatering operations in the Mobile, Charleston, and Norfolk Districts for both trenching and surveying/ sampling applications.
- Geotextiles (permeable textile materials) are being increasingly used in dike construction to provide tensile reinforcement where it will increase the overall strength of the structure. The selection of geotextiles for use in a containment dike is usually based on a substantial cost savings over feasible, practical, alternate solutions or on the improvement in performance of a design (e.g., more effective installation, reduced maintenance, or increased life).
- A monitoring program serves to verify benefits attained and to form a basis for updating or modifying the management approaches.
- Fluorescent dyes have been used since the early 1900s. Several have been developed and used with varying degrees of success in tracing surface and ground waters.

Why should ICs be addressed?

This EM provides detailed guidance on development, operation, and the post-operative phases of confined dredged material sites. Since most of the design criteria, testing protocols, and management aspects of such sites are well established and accepted, there may not be substantial need for a formal IC process associated with this EM and the actions covered by it.

Recommendation

Level 0 (no change needed).

Appendix H: Conclusion on the Evolution of the 1936 Flood Control Act (Chapter VI of EP 870-1-29, USACE, 1 July 1988)

Appendix H is composed of two items from EP 870-1-29 (USACE, 1 July 1988). The first item includes some brief excerpts from the Preface, which was signed in 1988 by Lt. General E.R. Heiberg, III. The second item is a six-page conclusions chapter (Chapter VI) from the same EP. Some key points from these two items are included in Section 8.

Excerpts from Preface

In 1936, in response to public demands for Federal aid for flood-prone areas of the country and for work relief in the midst of the Great Depression, Congress passed and President Roosevelt signed the first general flood control bill - the first piece of legislation to provide for flood relief throughout the country and to recognize that flood control “is a proper activity of the Federal Government.”

— New cost-sharing provisions (for flood control projects) were incorporated into the Water Resources Development Act of 1986 (Public Law 99-662) signed by President Ronald Reagan on 17 November 1986.

— The act (WRDA of 1986) thereby represents perhaps the most important change in Federal water resources policy since the passage of the 1936 Flood Control Act. However, these shifting political and economic developments should not obscure the one fact that remains constant: the Corps of Engineers’ firm commitment to the protection of life and property against natural disasters.

Chapter VI – Conclusion (pp 91–96)

The Flood Control Act of 1936 established an enormous commitment by the Federal government to protect people and property on approximately 100 million acres. The only limitations on Federal flood control projects were that the economic benefits had to exceed the costs, and local interests had to meet the ABC requirements for local projects. Since 1936, Congress has authorized the Corps of Engineers to construct hundreds of miles of levees, flood walls, and channel improvements and approximately 375 ma-

jor reservoirs. These remarkable engineering projects today comprise one of the largest single additions to the nation's physical plant—rivalled only by the highway system. They have saved billions of dollars in property damage and protected hundreds of thousands of people from anxiety, injury, and death. They stand today as one of the more significant marks of our technical skill and humane spirit.

It was that faith in technology and intensity of humanitarian spirit, exhibited especially during the catastrophic floods of 1936, that explains congressional willingness to adopt such sweeping legislation without examining its implications more thoroughly. Hundreds of determined citizens came to Washington in the spring of 1936 demanding "Flood Control Now." Congress and the President gave them what they wanted, hoping that in the future all the intertwined elements of America's river basins could be tied together in some acceptable fashion. President Roosevelt thought this could be accomplished in a year or two through the National Resources Committee. But in Congress the rivers-harbors flood control bloc, as it came to be called, hesitated to turn such politically sensitive questions over to a new and relatively unknown agency steadfastly linked to the President and distant from the legislative branch. The NRC's recommendation that Roosevelt veto the Wilson Copeland flood control bill was certainly justified on administrative and technological grounds, but it was poor political advice. Frederic A. Delano and Charles E. Merriam were men of vision and intelligence who should have accepted the fact that pork barrel legislation was a factor in the American democratic political process—especially in a presidential election year. President Roosevelt's public statements about using the NRC to scrutinize the pork barrel projects on rivers, harbors, and (after 1936) flood control legislation only stiffened congressional resistance to the agency. By the end of 1930s, even the Republicans had abandoned the NRC, seeing it more as an example of presidential authority than as a deterrent to irresponsible spending. Its elimination by Congress in 1943 was part of a general reaction against the whole concept of centralized Federal planning in which the rivers-harbors-flood control bloc was only one factor.

The long struggle between Roosevelt and Congress over the National Resources Committee had very unfortunate consequences for the development of the nation's water resources. It left this complex task in the hands of four independent Federal agencies: the Corps of Engineers, the Federal Power Commission, the Reclamation Bureau, and the Soil Conservation Service. For two decades or more, there was relatively little coordination

between these agencies except for establishing administrative boundaries. Only the Tennessee Valley Authority could claim it was engaged in unified multi-purpose water resources development; however, this was limited to the Tennessee River basin.

Fortunately, an increasing number of congressmen came to recognize after 1936 that the four national water resources agencies did not address the full range of water-related problems facing the nation and were not required to coordinate carefully those activities they did undertake. Consequently, the approximately 100 water resources laws passed since 1936 have added many new functions and agencies and have provided for closer and more constant cooperation between Federal water agencies and their counterparts at the state and local levels. While this still falls short of unified action, it is a major step forward from the situation in 1936.

The major agency in water resources is clearly the Army Corps of Engineers. This had been the case in the 19th century, and the Flood Control Act of 1936 assured that its role would be greatly enlarged during the balance of the 20th century. The 1936 Flood Control Act was also an important turning point in the scope of the Corps' water resources activities. From 1824 to 1936 the Civil Works program of the Corps consisted almost exclusively of navigation improvements. Even the vast lower Mississippi program of the 1879–1936 era contained a large navigation component. In the years after 1936, however, the Corps steadily widened its array of water resources activities. Much of this has resulted from legislation that has modified and enlarged the huge program of flood control reservoir construction. For example, one consequence of the 1936 Flood Control Act, which removed the ABC requirements from reservoirs, was that the Federal government remained the operator as well as builder of flood control dams. While this was a welcome relief to local interests faced with financing, operation, and maintenance under the 1936 Flood Control Act, it also purposely allowed the Federal government to develop hydroelectric power at reservoir sites. The Flood Control Act of 1944 provided for the establishment of park and recreation areas at Corps reservoirs and authorized the sale of “surplus” water for domestic and industrial use. Two years later, fish and wildlife protection in connection with flood control projects was authorized.

Water resources program coordination between the Corps of Engineers and other relevant Federal, state, and local governments has slowly evolved. Beginning with the Flood Control Act of 1944, coordination and

consultation between the Corps and other Federal agencies and affected states and localities have been mandated for the development and planning of projects. However, the final decision making still rests with Congress. The Water Resources Council (WRC), authorized in the Water Resources Planning Act of 1965, was as close as Congress ever came to creating the type of water resources coordination agency envisioned by the National Resources Committee, but the powers and activities of the WRC were far more modest than the old NRC or Franklin Roosevelt would have wished. President Reagan transferred the council's activities and personnel to other parts of the Executive Branch in 1982. In today's Corps of Engineers, water resources planning and coordination proceeds under the authority of approximately 100 pieces of Federal legislation, 22 executive orders, over 50 interagency agreements, and more than 60 Office of Management and Budget circulars. Such a jerry-built legislative and administrative structure is a clear improvement over the previous tradition of uncoordinated action, but it still falls short of a fully integrated water resources administrative framework.

Within the broad area of water resources development, the Corps' flood control program has changed dramatically over the past 50 years. A significant manifestation of this is the changing definition of the term "flood control" as contemplated in the 1936 act. This term has been enlarged to encompass the concepts of "flood damage reduction" and "optimum flood plain management." This conceptual change has been accompanied by a noticeable shift away from the almost exclusive use of large, expensive, and environmentally intrusive physical structures toward smaller ones and/or a wide range of nonstructural programs such as flood warning systems, flood insurance, flood plain information programs, and procedures to discourage new building development on flood plains. Neither Congress nor the Corps paid much attention to these alternative approaches until the 1950s and 1960s, when the TVA undertook a very successful flood plain management program, and the reports of water resources experts such as Gilbert White (who had begun his career in the 1930s with the National Resources Committee) gradually convinced Congress and the Corps that this was an important alternative to traditional structural solutions.

It is unfortunate that the research on floods and flood control carried out mainly since World War II by both government and academic investigators was not available in 1936. If so, millions of taxpayers' dollars might have been more effectively spent. On the other hand, it is not at all certain that Congress, in its haste to respond to an emergency, would have lis-

tened carefully to the full range of expert testimony even then available or that the exigencies of the pork barrel legislative process would have been overcome by rational inquiry. As a result, the flood control act that emerged in 1936 largely ignored multipurpose development and nonstructural alternatives. It sought to solve flood problems through vast construction projects that have in a number of cases been questioned by water resources experts. Nevertheless, the decisive step toward a remarkably sophisticated and imaginative flood plain management program was taken with the Flood Control Act of 1936, though few who supported it could possibly have foreseen where it would eventually lead. It speaks well of our political process that this emergency-born and single-minded flood control act has been gradually merged with rivers and harbors legislation to form the basis of a very successful multi-purpose water resources program. In terms of flood control alone, the present system provides a far more rational and equitable way of designing projects than the act provided in 1936. The fact that it took almost half a century to achieve is part of the price we pay for a free democratic society. On balance, it seems a price well worth paying.

Appendix I: Recommendations on Sixteen Regulations and Related Documents that Address Flood Damage Reduction Projects

EP 870-1-29, The Evolution of the 1936 Flood Control Act, J.L. Arnold, author, 1988

Description

This 123-page report documents the historical development of the Flood Control Act of 1936. Chapter I summarizes the origins of Federal flood control activity from 1849 to 1912. Chapters II through IV describes the river basin and flood control interests of Congress from 1912 to 1936. Finally, Chapter V summarizes the floods of 1936 and the specific development of the Flood Control Act of 1936.

Are incremental changes (ICs) mentioned?

No ICs are directly mentioned; however, referrals are made to influencing factors on the Nation's flooding experiences.

Why should ICs be addressed?

Because of the historical focus of EP 870-1-29, there is no need to modify this EP.

Recommendation

No changes are needed to EP 870-1-29 (Level 0 Recommendation).

EP 1110-2-7, *Hydrologic Risk*, May 1988

Description

This EP serves as a primer on how the USACE addresses the assessment of hydrologic risks in planning flood damage reduction projects. The EP is structured around the following questions: what is risk, how is the probability of flooding estimated, how does the USACE use probability estimates (in planning flood damage reductions projects), and what does this information mean to you?

Are incremental changes (ICs) mentioned?

No ICs are mentioned nor are there any inferences included that are related to ICs.

Why should ICs be addressed?

Because of the primer-related focus of EP 1110-2-7, there is no need to introduce ICs.

Recommendation

No changes are recommended for EP 1110-2-7 (Level 0 Recommendation).

ER 1110-2-1405, Hydraulic Design for Local Flood Protection Projects, 30 September 1982**Description**

This ER describes the procedure and rationale for the hydraulic design of a local flood damage reduction channel project. A generalized project design process is described along with the contents of a resultant design report. Examples of topics to be addressed include pre- and post-project conditions, protective design measures, hydraulic losses, water surface profile stability, approach and exit channels, operation and maintenance, free-board, care of water during construction, and side drainage.

Are incremental changes (ICs) mentioned?

Specific ICs were not mentioned, although general references to such topics were periodically included.

Why should ICs be addressed?

ICs can influence both current and future designs for new projects, as well as modifications for existing projects.

Recommendation

The term IC should be defined, added, and explained at appropriate places within this ER (Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an EP or ETL clarifying and explaining ICs in relation to the contents of ER1110-2-1405).

ER 1110-2-1464, Hydrologic Analysis of Watershed Runoff, 30 June 1994**Description**

This ER describes the scope of watershed-runoff studies, the multiple considerations associated with a study design, and reporting of the study results. The multiple considerations include identification of study purposes, assessment of controlling physical phenomena (study boundary, downstream areas, watershed properties and land use and urbanization, and future conditions), level of detail of study, selecting of methods of analysis (and their calibration, verification, and application), and uncertainty analysis. The study report contents are also addressed, including the location, project features and functions, methods used, interpretation of results, and uncertainties.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned; however, they are implied in relation to the importance of urbanization within study watersheds.

Why should ICs be addressed?

ICs can be a primary contributor to changes in runoff, so they should be addressed in watershed studies.

Recommendation

The term IC should be defined, added, and explained at appropriate places within ER 1110-2-1464. (This a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of ER 1110-2-1464.)

ER 1110-8-2 (FR), Inflow Design Floods for Dams and Reservoirs, 1 March 1991**Description**

This ER addresses hydrologic engineering requirements for selecting and accommodating Inflow Design Floods (IDFs) for dams and reservoirs. The basic policy is that dams designed, constructed, and operated by the USACE will not create a threat of loss of life or inordinate property damage. Four levels of safety standards are described, with the standards matching the various types and size categories for dams. IDF estimates are

based on hypothetical flood hydrographs developed from rainfall intensity, duration, area relationships (and snowmelt if pertinent), and runoff characteristics applicable to the drainage basin (implies land usage along with topography, soils, etc.). Reports on IDF determinations should be composed of several factors, including rainfall and runoff, hydrographs, water control plan, dam safety standard, etc.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned; however, they are implied in relation to the influence of watershed properties (and land use) on IDFs.

Why should ICs be addressed?

Historical IC information could be used in developing current IDFs, and consideration of future ICs could be used for projecting future IDFs.

Recommendation

The term IC should be defined, added, and explained at appropriate places within ER 1110-8-2 (FR). (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL clarifying and explaining ICs in relation to the contents of ER1110-8-2 (FR).)

ER 1110-2-50, Low Level Discharge Facilities for Drawdown of Impoundments, 22 August 1975

Description

This ER indicates that it is the policy of the USACE that lakes impounded by Civil Works projects be provided with low-level discharge facilities. Such facilities, capable of essentially emptying the lake, provide flexibility in future project operation for unanticipated needs such as major repairs of the structure, environmental controls related to thermal stratification, or changes in reservoir regulation. General design criteria are specified along with the contents of survey reports and pertinent design memoranda. Such contents should include related discharge rating curves; hydrographs with inflow, outflow, and pool stage plots; lake regulation plans needed for project purposes and needed to satisfy the drawdown criteria; and other data as appropriate.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned or implied in this ER. Further, because of the focus on low-level discharge facilities, it is unlikely that ICs would need to be addressed relative to such facilities.

Why should ICs be addressed?

As noted above, referrals to ICs related to low-level discharge facilities are not necessary in this ER.

Recommendation

IC-related information is not required for ER 1110-2-50, so no recommendation for change is made relative to this ER (Level 0 Recommendation).

ER 1165-2-21, Flood Damage Reduction Measures in Urban Areas, 30 October 1980**Description**

This ER provides policies and guidance for USACE participation in urban flood damage reduction projects, and it establishes criteria to distinguish between improvements to be accomplished by the USACE under its flood control authorities and storm sewer systems to be accomplished by local interests. Flood damage reduction works in urban areas refer to adjustments in land use and the facilities (structural and non-structural) designed to reduce flood damages in urban areas from overflow or backwater due to major storms and snowmelt. This ER also includes decision criteria for urban flood control projects. Further, it encourages cooperative planning with local authorities and other Federal agencies (e.g., EPA and HUD) as appropriate. Finally, it is noted that planning for local flood damage reduction projects should be accomplished within a coordinated comprehensive planning framework at the regional or river basin level.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned; however, they are frequently implied regarding historical and future changes in land use that may result in major alterations of the runoff characteristics of urban watersheds.

Why should ICs be addressed?

ICs can be a primary influence on changes in runoff characteristics in urbanizing watersheds. More detailed information in this ER (or a related document) would be useful.

Recommendation

The term IC should be defined, added, and explained at appropriate places within ER 1165-2-21. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of ER 1165-2-21.)

ER 1130-2-530, Flood Control Operations and Maintenance Policies, 30 October 1996**Description**

This ER contains the policy for the operation and maintenance of USACE flood damage reduction projects and USACE-built flood protection projects operated and maintained by non-Federal sponsors. Chapter 2 focuses on the safe and effective management and operation of dam and reservoir projects. Requirements for emerging plans are described; however, evaluation plans are local responsibilities. Chapter 3 addresses inspections of Federal flood control projects that are operated and maintained by non-Federal sponsors (ER 1110-2-100, *Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures*, is related to this ER). Several useful appendices include A, dam safety training for project personnel; B, evacuation plans for areas downstream; and C, overall project rating following inspection.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, although they are implied throughout this ER. In fact, periodic inspections and evaluations of dams and flood damage reduction projects can be prompted by several types of ICs.

Why should ICs be addressed?

ICs could be used to denote causative factors leading to the need for inspections and evaluations (ER 1110-2-100). The results from such evaluations could lead to modifications to completed projects (ER 1165-2-119).

Recommendation

The term IC should be defined, added, and explained at appropriate places within this ER. Further, examples of specific ICs should also be added, as appropriate, throughout the ER. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an EP or ETL clarifying and explaining ICs in relation to the contents of ER 1130-2-530.)

ER 1105-2-101, Risk Analysis for Flood Damage Reduction Studies, 3 January 2006

Description

This ER provides guidance on the evaluation framework to be used in flood damage reduction studies. Earlier studies were often conducted based on short periods of record, small data sets, and measurements subject to errors. Sensitivity analysis was often used, and the results were reported as a single, most likely value. This ER indicates that all flood damage reduction studies will adopt risk analysis as a tool. In this case, risk analysis refers to an approach that captures and quantifies the extent of the risk and uncertainty in the various planning and design components of a flood damage reduction project. The total effect of uncertainty on the project's design and economic viability can be examined, and conscious decisions can be made reflecting an explicit tradeoff between risks and costs. Further, risk analysis can be used to compare plans in terms of the variability of their physical performance, economic success, and residual risks.

A variety of planning and design variables may be incorporated into risk analysis in a flood damage reduction study. For example, economic variables in an urban situation may include, but are not necessarily limited to, depth-damage curves, structure values, content values, structure first-floor elevations, structure types, flood warning times, and flood evacuation effectiveness. For hydrologic and hydraulic analysis, the principal variables are discharge and stage. Uncertainty in discharge and stage may occur because record lengths are often short or do not exist where needed, and the effectiveness of flood flow regulation measures are not precisely known. Uncertainty in discharge also comes from estimation of parameters used in rainfall runoff computations, such as precipitation and infiltration. Uncertainty factors that affect stage might include conveyance roughness, cross-section geometry, debris accumulation, ice effects, sediment transport, flow regime, bed form, and others. Numerous ICs can con-

tribute to changes in these parameters and thus contribute to uncertainties. Based on this information, the ER suggests that, at a minimum, the following variables must be explicitly incorporated in the risk analysis: (1) the stage-damage function for economic studies (with special emphasis on structure first-floor elevation, depth-percent damage relationships, and content and structure values for urban studies); for studies in agriculture areas, other variables (e.g., time of year, crop type, and costs of production) will be key and should be used in the economic analysis; (2) discharge associated with exceedence frequency for hydrologic studies; (3) conveyance roughness and cross-section geometry for hydraulic studies; and (4) structural and geotechnical performance of existing structures.

The Standard Project Flood (SPF) has been used in many designs for flood damage reduction projects, and it is frequently referred to in ERs and EMs. However, in the context of ER 1105-2-100 (*Planning Guidance Notebook*, April 2000) and risk analysis guidance, the SPF is no longer a valid design target, having been superseded by more current guidance. Instead, a full range of floods, including those that would exceed the SPF, is to be used in formulating and evaluating alternatives.

Risk analysis reports are to quantify the performance of all scales of all alternatives considered for final recommendation. The analysis evaluates and reports residual risk, which includes consequence of project capacity exceedence. This requires the explicit consideration of the joint effects of the uncertainties associated with key hydrologic, hydraulic, and geotechnical variables. This performance should be reported in the following ways: (1) the annual exceedence probability with associated estimates of uncertainty; (2) the equivalent long-term risk of exceedence over 10, 30, and 50 years; and (3) the ability to contain specific historic floods. The distribution of residual flood damage and other relevant aspects of residual risks shall also be displayed. The residual risk shall be reported as the expected annual probability of each alternative being exceeded. For comparison purposes, the without-project risk in terms of the annual probability of flood damages occurring and the annual probability of other property hazards (fire, wind, etc.) will be displayed. Residual human health and safety risks should also be displayed. To aid this display and to improve the understanding of the residual risk, inundation maps showing flood depths, should the project be exceeded, shall also be provided. In addition, a narrative scenario for events that exceed the project design shall be provided. Finally, Appendix A of this ER includes example displays of risk analysis results.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned but they are implied throughout ER 1105-2-101 as causative factors related to the uncertainties as described above.

Why should ICs be addressed?

Numerous uncertainties are associated with ICs themselves. This concept could be incorporated in ER 1105-2-101.

Recommendation

The term IC should be defined, added, and explained at appropriate places within ER 1105-2-101. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of ER 1105-2-101.)

ER 1165-2-121, Flood Control Cost-Sharing Requirements Under the Ability-to-Pay Provision – Section 103 (M) of PL 99-662, 1 November 1989**Description**

This ER provides instructions on the implementation of Section 103(M) of the Water Resources Development Act of 1986 (PL 99-662). Section 103(M) addresses “ability-to-pay” for local non-Federal sponsors of flood damage reduction projects. This ER describes a three-step process that could be used to reduce the sponsor’s share of the costs of a flood damage reduction project.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned or implied in this ER. Further, because of the focus on non-Federal cost sharing based on the ability-to-pay provision of WRDA 1986, it is unlikely that ICs would need to be addressed relative to this ER.

Why should ICs be addressed?

As noted above, references to ICs related to the multiple issues of cost-sharing are not necessary in this ER.

Recommendation

IC-related information is not required for ER 1165-2-121, so no recommendation for change is made relative to this ER (Level 0 Recommendation).

ER 1130-2-406, *Shoreline Management at Civil Works Projects*, 31 October 1990 to 28 May 1999**Description**

This ER provides policy and guidance on management of shorelines associated with Civil Works projects. The Code of Federal Regulations (at 36 CFR 327) contains supporting rules and regulations governing the public use of water resources development projects. The general policy is that shorelines should be protected and managed in a manner that will promote the safe and healthful use of these shorelines by the public while maintaining environmental safeguards to ensure a quality resource for use by the public. The objectives of all management actions will be to achieve a balance between permitted private uses and resource protection for general public use. When private shoreline use is allowed, the USACE is to develop a Shoreline Management Plan and review it every five years. Shoreline allocations can be made relative to designated categories such as limited development areas, public recreation areas, protected shoreline areas, and prohibited access areas. Tools for management include shoreline use permits, Section 10 and/or Section 404 permits, and instruments such as leases or licenses.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, but they are implied throughout this ER. Further, because of the focus on shoreline management, permits, etc., it is unlikely that ICs would need to be addressed in this ER.

Why should ICs be addressed?

As noted above, referrals to ICs related to Civil Works projects per se are not necessary in this ER.

Recommendation

IC-related information is not required for ER 1130-2-406, so no recommendation for change is made relative to this ER (Level 0 Recommendation).

ER 1130-2-550, *Recreation Operations and Maintenance Policies*, 15 November 1996. (Changes on 1 October 1999; 1 March 2002; 15 August 2002; 30 August 2008; and 30 March 2009)

Description

This ER establishes the policy for management of recreation programs and activities, and operation and maintenance of USACE recreation facilities and related structures at water resources projects. Fifteen chapters include topics such as recreation management, project master plans and operation management plans, visitor center programs, use of off-road vehicles, natural resource management system, and recreational use survey.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, but they are implied in several chapters. In fact, the entire recreational program at USACE projects has undergone ICs for several decades.

Why should ICs be addressed?

If ICs are influencing recreational programs and practices, some attention needs to be given to examples within this ER. Further, such information could prompt changes in policies and practices.

Recommendation

The term IC should be defined, added, and explained at appropriate places within this ER. Further, examples of specific ICs should also be added, as appropriate, throughout the ER. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an EP, updated EP (EP 1130-2-550), or ETL clarifying and explaining ICs in relation to the contents of ER 1130-2-550.)

EP 1130-2-550, *Recreation Operations and Maintenance Guidance and Procedures*, 15 November 1996. (Changes on 1 October 1999; 1 March 2002; 15 August 2002; and 30 August 2008.)

Description

This EP supplements ER1130-2-550, including the same 15 chapter topics. Each contains more detailed information in this 151-page EP.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, but they are implied in several chapters. In fact, and as noted for ER 1130-2-550, the entire recreational program at USACE projects has undergone ICs for several decades.

Why should ICs be addressed?

If ICs are influencing recreational programs and practices, some attention needs to be given to examples within this EP. Further, such information could prompt changes in policies and practices.

Recommendation

The term IC should be defined, added, and explained at appropriate places within this EP. Further, examples of specific ICs should also be added, as appropriate, throughout the EP. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL clarifying and explaining ICs in relation to the contents of EP 1130-2-550.)

ER 1165-2-26, Implementation of Executive Order 11988 on Flood Plain Management, 30 March 1984**Description**

This ER contains general policy and guidance for the USACE implementation of EO 11988. The EO itself was issued on 24 May 1977. (As of August 2009, revisions are being considered in EO 11988.) The general theme of EO 11988 is that Federal agencies are to recognize the significant values of flood plains and to consider public benefits that would be realized from restoring and preserving flood plains. This ER indicates that it is USACE policy to formulate projects that, to the extent possible, avoid or minimize adverse impacts associated with use of the base flood plain (one percent chance flood plain) and avoid inducing development in the base flood plain unless there is no practicable alternative. Further, this ER contains an eight-step procedure for implementing EO 11988.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, although they are certainly implied throughout this ER. In fact, ICs in defined flood plains can accumulate to the point that flood plain sustainability would be in question.

Why should ICs be addressed?

ICs could be used to denote causative factors leading to non-compliance with EO 11988. Further, examples of ICs could be used to aid the USACE in mitigating potential flood plain losses.

Recommendation

The term IC should be defined, added, and explained at appropriate places within this ER. Further, examples of specific ICs should also be added, as appropriate, throughout the ER. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an EP or ETL clarifying and explaining ICs in relation to the contents of EP 1165-2-26.)

ETL 1110-2-569, Design Guidance for Levee Underseepage, 1 May 2005**Description**

The purpose of this ETL is to provide interim guidance for the design of levees to minimize the adverse effects of levee seepage. Included in this ETL is an eight-step procedure that incorporates data gathering, field testing, design calculations, and the potential use of computer models for seepage analysis.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned or implied in this ETL. Further, because of the focus on levee design to minimize underseepage, it is unlikely that ICs would need to be addressed relative to flood damage reduction projects.

Why should ICs be addressed?

As noted above, referrals to ICs related to flood damage reduction projects are not necessary in this ETL.

Recommendation

IC-related information is not required for ETL 110-2-569, so no recommendation for change is made relative to this ETL (Level 0 Recommendation).

EP 1165-2-314, *Flood Proofing*, 15 December 1995**Description**

The original EP under this number was published in June 1972; the title was *Flood Proofing Regulations*. A revised edition was published in March 1992, with the above-cited EP being released in December 1995. The USACE has continued this current EP so that planners and practitioners can apply flood proofing considerations, along with flood plain management tools, to reduce the threat to life, health, and property. This 85-page EP is filled with detailed information on numerous topics, including waterproofing, drainage, and designs of flooring, walls, and ceilings.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned or implied in this EP. Further, because of the focus on flood proofing, it is unlikely that ICs would need to be addressed relative to dams, levees, and general flood plain management.

Why should ICs be addressed?

As noted above, references to ICs related to flood damage reduction projects are not necessary in this EP.

Recommendation

IC-related information is not required for EO 1165-2-314, so no recommendation for change is made relative to this EP (Level 0 Recommendation).

Appendix J: Recommendations on Eight Engineer Manuals for Flood Damage Reduction Projects

EM 1110-2-1205, Environmental Engineering for Flood Control Channels, 15 November 1989

Description

This EM provides guidance for incorporating environmental considerations in the planning, engineering, design, and construction of flood control channels, levees, and associated structures. The emphasis is on projects that involve modifications of natural stream channels to reduce damages due to flooding, bed scour, or bank erosion. The focus is on channels not open to commercial navigation. Channel modifications for flood and erosion control include clearing and snagging; channel straightening; channel enlargement; streambank protection; channel lining; and construction of grade control structures, culverts, levees, and floodwalls. This EM also covers some of the principal environmental factors that should be considered in projects that involve stream channel modification, as well as opportunities for incorporating environmental features into these projects. The 97-page manual includes chapters on stream channel modification and associated environmental effects (Ch. 2), environmental considerations for preliminary design (Ch. 3), design (Ch. 4), and construction and maintenance (Ch. 5). Finally, environmental data collection and analysis (Ch. 6) and mitigation decision analysis are addressed (Ch. 7).

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, although they are implied throughout this EM. In fact, specific designs and environmental effects can be prompted by several types of ICs.

Why should ICs be addressed?

ICs could be used to denote causative factors leading to the need for local flood control channels. Further, such ICs can influence project design and evaluation.

Recommendation

Upon completion of further work on this IC project, consideration could be given to the appropriate addition of direct or implied referrals to ICs in this EM. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of EM 1110-2-1205; however, this determination should be postponed until the completion of further work on this IC project.)

EM 1110-2-1411, Standard Project Flood Determination, 1 March 1965**Description**

This EM, which was originally published in November 1946, was updated in March 1965. The 37-page, 1965 EM defines terms and describes processes for determining the Standard Project Flood (SPF), Standard Project Storm (SPS), and design floods. Further, examples of data needs and calculations are included. This EM has had extensive use for several decades; however, as risk analysis is now being used for flood damage reduction studies (ER 1105-2-101 and EM 1110-2-1619), EM 1110-2-1411 is being phased out.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned; however, they are implied throughout EM 1110-2-1411.

Why should ICs be addressed?

ICs can influence the determination of SPFs, SPSs, and design floods.

Recommendation

No IC-related changes are recommended for EM 1110-2-1411 (Level 0 Recommendation).

EM 1110-2-1417, Flood-Runoff Analysis, 31 August 1994**Description**

This 214-page EM describes methods for evaluating flood-runoff characteristics of watersheds. The EM itself is divided into four parts: problem definition and selection of methodology, hydrologic analysis, methods for flood-runoff analysis, and engineering applications. A total of 17 chapters

make up the four parts. As would be anticipated, detailed examples, calculations, and modeling are addressed throughout this EM. Depending on specific watershed characteristics, land usage, and rainfall patterns, the influence of numerous ICs on flood-runoff could be calculated.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, but they are implied throughout this EM. Pending the findings of the IC project, it might be appropriate to add relevant IC information into selected chapters within EM 110-2-1417.

Why should ICs be addressed?

ICs can influence flood-runoff characteristics, so such information could be used in project design and operation.

Recommendation

Upon completion of further work on this IC project, consideration could be given to the appropriate addition of direct or implied references to ICs in this EM. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of EM 110-2-1417; however, this determination should be postponed until the completion of further work on this IC project.)

EM 1110-2-1418, Channel Stability Assessment for Flood Control Projects, 31 October 1994

Description

This 117-page EM addresses the determination of potential channel instability and sedimentation effects in flood damage reduction projects. Further, this EM is intended to facilitate consideration of the type and severity of stability and sedimentation problems, the need for and scope of further hydraulic studies to address those problems, and design features to promote channel stability. The approaches are mainly qualitative and are intended to assist in the early stages of project formulation to forecast the type and magnitude of channel stability problems. In addition, EM 1110-2-4000 (*Sedimentation Investigations of Rivers and Reservoirs*) suggests three stages of sediment studies: sediment impact assessment, detailed sedimentation study, and feature design sedimentation study. This EM should be useful in the first stage of the staged sedimentation study.

EM 1110-2-1418 includes six chapters: Introduction (Ch. 1), Channel Stability Principles (Ch. 2), Stability Problems with Flood Control Channels (Ch. 3), Assembly of Information for Stability Evaluation (Ch. 4), Evaluation of Stability (Ch. 5), and Practical Aspects of Stability Design (Ch. 6). Finally, it should be noted that channel stability issues can result from natural geomorphological characteristics of streams, as well as societal-induced contributions resulting from various land uses.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, but they are implied throughout this EM.

Why should ICs be addressed?

ICs can influence channel stability characteristics of flood damage reduction projects.

Recommendation

Upon completion of further work on this IC project, consideration could be given to the appropriate addition of direct or implied referrals to ICs in this EM. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of EM 1110-2-1418; however, this determination should be postponed until the completion of further work on this IC project.)

EM 1110-2-1419, Hydrologic Engineering Requirements for Flood Damage Reduction Studies, 31 January 1995**Description**

This EM integrates hydrologic engineering requirements with the National Economic Development (NED) objective in water resources planning. This 68-page document includes ten chapters. Chapter 1 describes the planning problem, the flood damage reduction measures that may be included as solutions, the criteria for identifying the recommended solution, and the policies and procedures to be followed. Common hydrologic engineering requirements are described in Chapter 2; Chapter 3 describes the without-project conditions; and measure-specific requirements (reservoirs, diversions, channel modifications, levees and floodwalls, etc.) are addressed in Chapters 4–9. Finally, Chapter 10 describes how the measures may be combined and the formulation and evaluation requirements for such plans. Engineering factors related to the design of the measures, along

with the environmental consequences of the measures, are also addressed in Chapters 4–9.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, but they are implied throughout this EM.

Why should ICs be addressed?

ICs can influence the selection, design, and operational features of various measures.

Recommendation

Upon completion of further work on this IC project, consideration could be given to the appropriate addition of direct or implied references to ICs in this EM. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of EM 1110-2-1419; however, this determination should be postponed until the completion of further work on this IC project.)

EM 1110-2-1420, Hydrologic Engineering Requirements for Reservoirs, 31 October 1997

Description

This EM provides guidance for hydrologic engineering investigations associated with the planning and design of reservoir projects. The manual includes four parts: basic hydrologic concepts for reservoirs (Part 1), hydrologic data and analytical models (Part 2), storage requirements for various project purposes (Part 3), and hydrologic engineering studies (Part 4). This 115-page manual includes 17 chapters. Examples of the topics include reservoir purposes (Ch. 2), multi-purpose reservoirs (Ch. 3), flood-runoff analysis (Ch. 7), reservoir sediment analysis (Ch. 9), flood control storage (Ch. 10), and spillways and outlet works (Ch. 14). Several other EMs and ERs are related to the topics covered in EM 1110-2-1420.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, but they are implied throughout this EM.

Why should ICs be addressed?

ICs can influence the design and operation of different types of projects, as well as the comparisons of different choices.

Recommendation

Upon completion of further work on this IC project, consideration could be given to the appropriate addition of direct or implied references to ICs in this EM. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of EM 1110-2-1420; however, this determination should be postponed until the completion of further work on this IC project.)

EM 1110-2-1619, Risk-Based Analysis for Flood Damage Reduction Studies, 1 August 1996**Description**

This EM, which is a corollary to ER 1105-2-101 (*Risk Analysis for Flood Damage Reduction Studies*), describes and provides procedures for addressing risk and uncertainty for flood damage reduction studies. This 64-page document includes nine chapters covering the following topics: a summary of procedures presented in this EM, and brief definitions of terms used (Ch. 1), an overview of USACE's plan formulation and economic evaluation procedures, and an overview of procedures for uncertainty analysis (Ch. 2), procedures for evaluating engineering performance of damage-reduction measures (Ch. 3), guidance on describing uncertainty of discharge and stage frequency functions (Ch. 4), guidance on describing uncertainty of stage-discharge functions (Ch. 5), guidance on describing uncertainty of stage-damage functions (Ch. 6), templates for displaying uncertainty analysis results (Ch. 7), references including USACE publications that are pertinent to uncertainty analysis and other references that may be useful (Ch. 8), and an example of plan formulation and evaluation in which uncertainty is considered (Ch. 9).

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned, but they are implied throughout this EM.

Why should ICs be addressed?

ICs can influence risk and uncertainty associated with flood damage reduction studies.

Recommendation

Upon completion of further work on this IC project, consideration could be given to the appropriate addition of direct or implied references to ICs in this EM. (This is a Level 1 Recommendation, denoting the introduction of ICs and their addition, as appropriate, throughout the document, or the issuance of an ETL or EP clarifying and explaining ICs in relation to the contents of EM 1110-2-1619; however, this determination should be postponed until the completion of further work on this IC project.)

EM 1110-2-1913, Design and Construction of Levees, 30 April 2000**Description**

This EM presents basic principles that can be used in the design and construction of earthen levees. The 164-page manual includes eight chapters and seven technical appendices. Ch. 1 presents an introduction, while Ch. 2 and 3 address field investigations and laboratory testing, respectively. Ch. 4 highlights borrow areas, and Ch. 5 incorporates designs for seepage control. Slope design and settlement are the subjects of Ch. 6. Ch. 7 focuses on levee construction and Ch. 8 highlights special features, such as pipelines and other utility lines crossing levees. In general, this EM contains detailed information on engineering design and construction.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned or implied in EM 1110-2-1913.

Why should ICs be addressed?

Because of the specific design and construction focus of this EM, there is no reason for adding ICs to this EM.

Recommendation

No IC-related changes are recommended for EM 1110-2-1913 (Level 0 Recommendation).

Appendix K: Recommendations on Six Regulations and Related Documents for Ecosystem Restoration Projects

EP 1165-2-1, *Digest of Water Resources Policies and Authorities*, 30 July 1999. Chapter 19 – Environmental Restoration and Protection

This digest is being revised (2009). A draft is out for review comment. The review below is for the 1999 version.

Description

This pamphlet provides a brief summary, in digest form, of the existing administrative and legislative water resources policies and authorities pertinent to the Civil Works activities of the USACE. Significant legislation discussed in the EP is the Clean Water Act of 1977, the Water Resources Development Act of 1974 and 1976, the River and Harbor and Flood Control Act of 1970, and the National Environmental Policy Act of 1969.

Chapter 19 on Environmental Restoration and Protection attempts to clarify the linkages among various environmental statutes and programs and policies established by WRDAs. The ecosystem approach consists of restoring and hydrologically protecting the structure and function of an ecosystem, or parts thereof, recognizing that all its components are interrelated (Section 19-4).

Are incremental changes (ICs) mentioned?

Chapter 3 of this EP states that the cumulative effects of the plan and other similar activities should be analyzed. Each proposed water resource development is but a piece of a large-scale program. “The combined beneficial and adverse economic, environmental and social impacts of individual projects, each of which may be relatively minor, can have a significant regional or national impact. At each level of the evaluation and review process it is necessary to assess the cumulative beneficial and adverse effects of individual project impacts. Significant effects should guide the decisions.”

Specifically, “incremental” is primarily mentioned in terms of incremental cost analysis, cost sharing, and mitigation.

The chapter on environmental restoration lists the authorities supporting ecosystem restoration (e.g. Fish and Wildlife Coordination Act of 1958, as amended; National Environmental Policy Act of 1969, as amended; Coastal Zone Management Act of 1972, as amended; and Endangered Species Act of 1973, as amended; and Water Resources Development Acts of 1986, 1988, 1990, 1992, and 1996). ICs are included in these authorities. For example, Section 1135 of WRDA 1986, as amended, recognizes the potential for modifying existing USACE project structures, operations, and/or areas where the USACE projects contributed to the degradation of the ecosystem for the purposes of providing environmental benefits in the public interest (Section 19-29).

The ecosystem approach also recognizes and seeks to address the problems of habitat fragmentation and the piecemeal restoration and mitigation efforts that have been previously applied in dealing with the Nation’s natural resources.

This digest provides an overview of environmental authorities within WRDA from 1986 to 1996. It also talks about wetlands policy and WRDA sections pertaining to wetlands. An overview of ESA, Section 7 requirements is also provided.

Mitigation principles pertaining to fish and wildlife resources are also discussed. The objective concerning mitigation is to maintain the integrity and viability of significant natural resources and their contributions to local and regional ecosystems, rather than considering all resource losses inherently equal. Mitigation plans shall be justified incrementally, i.e. when an increment or management measure is added to a plan, it should increase the plan’s net benefits (Section 19-21).

Why should ICs be addressed?

Because of the focus of this EP, information on ICs would be relevant.

Recommendation

This EP is comprehensive in its coverage. It is currently being revised. Although the section on cumulative effects recognizes that impacts of individual projects can be relatively minor, combined effects can have a signif-

ificant impact; the term IC is not used. The term IC should be defined and added in appropriate places within this pamphlet (Level 1 recommendation).

EP 1165-2-501, Civil Works Ecosystem Restoration Policy, September 30, 1999

Description

This regulation provides policy on USACE involvement in ecosystem restoration and protection through Civil Works programs and activities. The purpose of Civil Works ecosystem restoration activities is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Ecosystem restoration efforts will involve a comprehensive examination of the problems contributing to the system degradation and the development of alternative means for their solution. The intent of restoration is to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system. USACE ecosystem restoration projects should utilize engineering and other technical solutions to water and related land resources problems, with an emphasis on improving degraded ecosystem function and structure.

Are incremental changes (ICs) mentioned?

ICs are not directly mentioned; however, they are implied in the document. Examples are provided below:

- Authorities through which USACE can participate in study, design and implementation of ecosystem restoration and protection projects include: (1) Section 1135 of WRDA 1986, as amended; (2) Section 206 of WRDA 1996; (3) Section 204 of WRDA 1992, as amended; and (4) Section 312 of WRDA 1990 as amended.
- The ICs are associated with “Quality Control and Assurance,” “Water Quality,” and “Major Rehabilitation.” An example can be found in Section 14, “Ecosystem restoration opportunities may be included as part of major rehabilitation program.”
- Another example is shown in Section 16. “The Corps’ Regulatory program encourages development of watershed management plans that protect and restore important elements of aquatic ecosystems.”

These two sections of the policy explain the need of ICs, with restoration as one of the goals.

Why should ICs be addressed?

Because of the focus of this ER, information on ICs would be relevant.

Recommendation

The term IC should be defined and added within this ER (Level 1 recommendation: introduce ICs and add, as appropriate, throughout the document, or issue an ETL expanding ICs in relation to the contents of ER 1165-2-501.)

EP 1165-2-502, Ecosystem Restoration – Supporting Policy Information, 30 September 1999**Description**

National policy concerning the protection, restoration, conservation, and management of ecological resources is provided through numerous Federal laws, executive orders and treaties promulgated in recent decades. These provisions include compliance requirements and emphasize protecting environmental quality. This pamphlet provides policy information in support of ER 1165-2-501 to guide USACE involvement in ecosystem restoration and protection through Civil Works programs and activities. Recent water resources authorizations have enhanced opportunities for USACE involvement in studies and projects to specifically address objectives related to the restoration of ecological resources. Specific authorities for new individual studies and projects to restore ecological resources have also been provided in legislation.

Are incremental changes (ICs) mentioned?

This document, titled *Supporting Policy Information*, is a more complete guide. ICs are not directly mentioned; however, they are implied throughout the EP:

- Authorities that include compliance requirements and emphasize protecting environmental quality include the Fish and Wildlife Coordination Act of 1958, as amended; the Federal Water Project Recreation Act of 1965, as amended; the National Environmental Policy Act of 1969, as amended; the Coastal Zone Management Act of 1972, as amended; the Water Pollution Control Act of 1972, as amended; the Endangered Species Act of 1973, as amended; the Water Resource Development Acts of 1986, 1988, 1990, 1992, 1996; and the Coastal Wetlands Planning, Protection and Restoration Act of 1990.

- Section 7.c. states “Ecosystem Restoration is a primary mission of the Civil Works program.” This section also mentions that partial restoration may be possible, with significant and valuable improvements made to degraded ecological resources.
- Section 7.d. states that the purpose of Civil Works ecosystem restoration activities is to restore significant ecosystem function, structure, and dynamic processes that have been degraded. Protection measures may involve efforts to prevent future degradation of elements of an ecosystem’s structure and functions.
- Section 7.l. explains that the USACE activities in ecosystem restoration should concentrate on engineering and technical solutions to water and related land resources problems, with an emphasis on improving degraded function and structure.
- Section 16 summarizes ecosystem restoration evaluation information that could be used as a guide for formulating, evaluating, and selecting ecosystem restoration alternatives. Section 16.a. (2) states that incremental cost analyses identify changes in costs for increasing levels of environmental output. They are used to help assess whether it is worthwhile to incur additional costs in order to gain increased environmental outputs.

Why should ICs be addressed?

Because of the focus of this EP, information on ICs would be relevant.

Recommendation

This EP is comprehensive in its coverage. The recommendation is Level 0 (no change needed). However, because this is a key document that provides policy information in support of ER 1165-2-501, it is recommended that the term IC be defined and added in appropriate places within the EP when the EP is next updated.

ER 1130-2-540, Environmental Stewardship Operations and Maintenance Policies, 15 November 1996

Description

This regulation establishes land management policy for USACE-administered project lands and water, based on various authorizing legislation and the principles of good environmental stewardship. It mentions that ecosystem management by the USACE shall be a proactive, goal-driven approach to sustaining ecosystems and their values. This is a broad

regulation, covering such topics as natural resources stewardship, pest control, forest pest suppression assistance at Civil Works water resources development projects, cultural resources Management, and fire management.

Are incremental changes (ICs) mentioned?

Incremental changes are not specifically mentioned in this ER. Evidence of ICs is included in the following. Change 1 (4 November 2002) adds Chapter 7 to the 1996 guidance, which is on the Stewardship Support Program. Change 2 31 (July 2005) adds Chapter 8, which provides guidance and policy for the development of a project Fire Management Program. Change 3 11 (August 2008) revises Chapter 8 and updates policy in accordance with Section 2012 of WRDA 2007.

Why should ICs be addressed?

Because of the broad nature of this regulation, there may not be any need to address ICs.

Recommendation

Level 0 (no change needed). When this regulation is next updated, the term IC should be defined and added at appropriate places within this regulation (Level 1). Upon completion of further work on the Incremental Changes Project, this recommendation may change to a Level 1.

ER 1165-2-27, Establishment of Wetlands Areas in Connection with Dredging, 18 August 1989

Description

This ER provides guidance for the establishment of wetland areas in connection with dredging required as part of water resources development projects. Environmental, economic, and social benefits of the wetland area justify the increased cost above that required for alternative methods of disposing of dredged material for such project; the increased cost of such wetland area will not exceed \$400,000. Wetlands must be primarily the result of dredged material placement and must be designed to produce beneficial functional values.

Are incremental changes (ICs) mentioned?

This is a concise and old regulation; ICs are not specifically mentioned in this ER.

Why should ICs be addressed?

Because of the focus of this EP, information on ICs would be relevant.

Recommendation

No IC-related changes are necessary to this ER. When this regulation is next updated, the term IC should be added. ICs should be explained in appropriate places within the regulation (Level 1 recommendation).

ER 1165-2-28, Corps of Engineers Participation in Improvements for Environmental Quality, 30 April 1980**Description**

This regulation provides guidance for including environmental quality measures in USACE water resource development plans. Enhancement of the environment is an objective of Federal water resource programs to be considered in the planning, design, construction, and operation and maintenance of projects. Opportunities for enhancement of the environment are sought through each of these phases of project development. Laws promulgated in the past decade require that “the quality of the environment be protected and, where possible, enhanced as the nation grows.” As a result, the Federal role in environmental quality, including the USACE, is to balance the economic and environmental interests in the planning of all USACE projects.

Are incremental changes (ICs) mentioned?

This is a concise and old regulation; ICs are not specifically mentioned in this ER. An example where ICs are implied is in Section 5.a. (2), which states “measures proposed for Environmental Quality must enhance, preserve or restore the environment of the study area.”

Recommendation

No IC-related changes are necessary to this ER (Level 0 recommendation). Engineer regulations that were developed in later years offered detailed information in areas (e.g. cost sharing) that were just mentioned in this ER. For example, EP 1165-2-1 (*Digest of Water Resources Policies and Authorities*) has a chapter on cost sharing.

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